SEPTEMBER 2015

NATIONAL GEOGRAPHIC

CENTRAL AFRICAN REPUBLIC

SOUTH SUDAN

IVORY

A smuggled tusk.
A hidden GPS chip.
A crime story.

Myanmar's Toughest Climb

Colorful Language of Chameleons

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NATIONAL GEOGRAPHIC

SEPTEMBER 2015 • VOL. 228 • NO. 3

Above a sea of clouds, Renan Ozturk pauses on a slope of Hkakabo Razi. He was one of three climbers making a summit attempt on the mountain, believed to be Myanmar's highest.

Tracking Illegal Traders

It was one of those audacious ideas that had a touch of the crazy: Hunt the elephant hunters.

First build a fake tusk, one that looked so good it could fool the experts—in this case, poachers. Then hide a GPS device inside it. Finally track that signal by satellite, and map the trail of the bad guys. Best-case results: Expose the workings of the illegal ivory trade, which from 2009 to 2012 led to the slaughter of 100,000 African elephants. This barbarous racket also exacts a devastating human toll, from looted villages and kidnapped children to raped women and dead park rangers.

Trade in ivory helps bankroll the Lord's Resistance Army, infamous for killings and abductions in east and central Africa. Former LRA child conscript Michael Oryem says he helped poach and hide ivory: Once he escaped, he led U.S. and Ugandan forces to a cache.

That's what inspired the National Geographic investigation reported in this issue, the first in a series we'll feature in the magazine and at *nationalgeographic.com.* The stories come from our new Special Investigations Unit, which is the brainchild of Bryan Christy, National Geographic's 2014 Explorer of the Year and a passionate warrior against wildlife crime.

"To protect wildlife and stop criminals, people first have to know the stories," Christy says. "I don't want anyone to be able to say, 'There's nothing I could have done,' or 'I didn't know.'"

Start by knowing this: The thriving, global illegal wildlife trade—including sales of endangered species and products made from them—is worth billions of dollars annually. The trade not only kills elephants, turtles, crocodiles, and other animals. It also brings big bucks to smugglers, crime syndicates, and terrorists. In a 2013 executive order aimed at combating wildlife crime, President Barack Obama called the surge in poaching and trafficking an "international crisis" that is "fueling instability and undermining security."

On this topic, Christy's zeal—and that of photographer Brent Stirton, whose moving work is highlighted here—is shared across the National Geographic Society. Protecting wildlife is a top priority for this organization.

I like how Christy puts it: "I hate an unfair fight," he says. "And the battle to protect endangered species from commercial exploitation is the unfairest fight I know."

Susan Goldberg, *Editor in Chief*

Warlords of Ivory, the premiere episode of National Geographic's EXPLORER series, will air on August 30 at 8 p.m. on the National Geographic Channel. The film will feature the work of the Special Investigations Unit, which is made possible by contributions from individuals and institutions. Find out how you can support this mission at ***donate.ngs.org/HelpSIU.***

PHOTO: BRENT STIRTON

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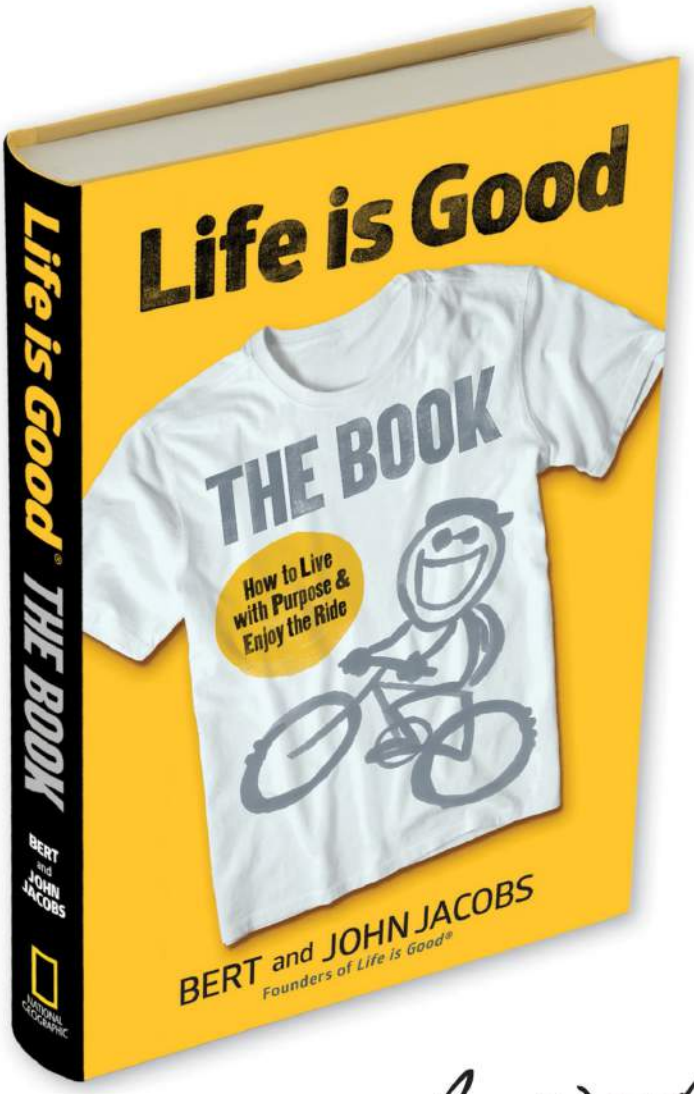
NATIONAL GEOGRAPHIC

We believe in the power of science, exploration, and storytelling to change the world.

The National Geographic Society
is a global non-profit membership organization. We inspire through exploration, illuminate through stories, and, always, teach.

Embrace the Good in Life.



From Life is Good® founders and brothers Bert and John Jacobs, this whimsically illustrated book teaches you how to harness their ten "super-powers" that can help everyone of us live with purpose and enjoy the ride.

Bert Jacobs

John Jacobs

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Why Animals Make Us Better People

Jan Pol, the 73-year-old veterinarian and star of the Nat Geo WILD channel's hit series *The Incredible Dr. Pol,* grew up in the Netherlands. He first visited rural Michigan as a high school exchange student and then moved there permanently after veterinary school. He and his wife, Diane, started treating animals out of their home and today run a busy practice—even when the Nat Geo cameras are off. Learn more about Pol at *facebook.com/TheDrPolOfficial.*

Why is the interaction between humans and animals so important?
I think that animals make us better humans. This is why I am so active in 4-H. The children have to take care of the animals before they can do anything else. It teaches them responsibility. When Diane and I moved here 35 years ago, our kids were small. We went into 4-H, and we still are active in it. 4-H pushes children to take responsibility for the animals. That includes nutrition, taking care of them, and also vaccinations, grooming. All these things we teach the children so they know. It all makes a kid a better person later in life.

What are the best and worst parts of your job as a veterinarian?
The best is that we help animals get better. Then through that, we help people. The worst part is when we have to put animals down. As I tell my clients, animals are not afraid to die. And when the quality of life is gone, let them go. I go to church. I believe in the hereafter. For me it seems like there should be a heaven for animals too.

What's the most crucial thing owners can do for pets?
The main thing is: Spay or neuter your animals!

New episodes of *The Incredible Dr. Pol* air at 9 p.m. ET/PT, Saturdays from July 25 through September 26, on Nat Geo WILD.

PHOTO: CHRIS BUCK

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EXPLORE

Planet Earth

Storm Surge

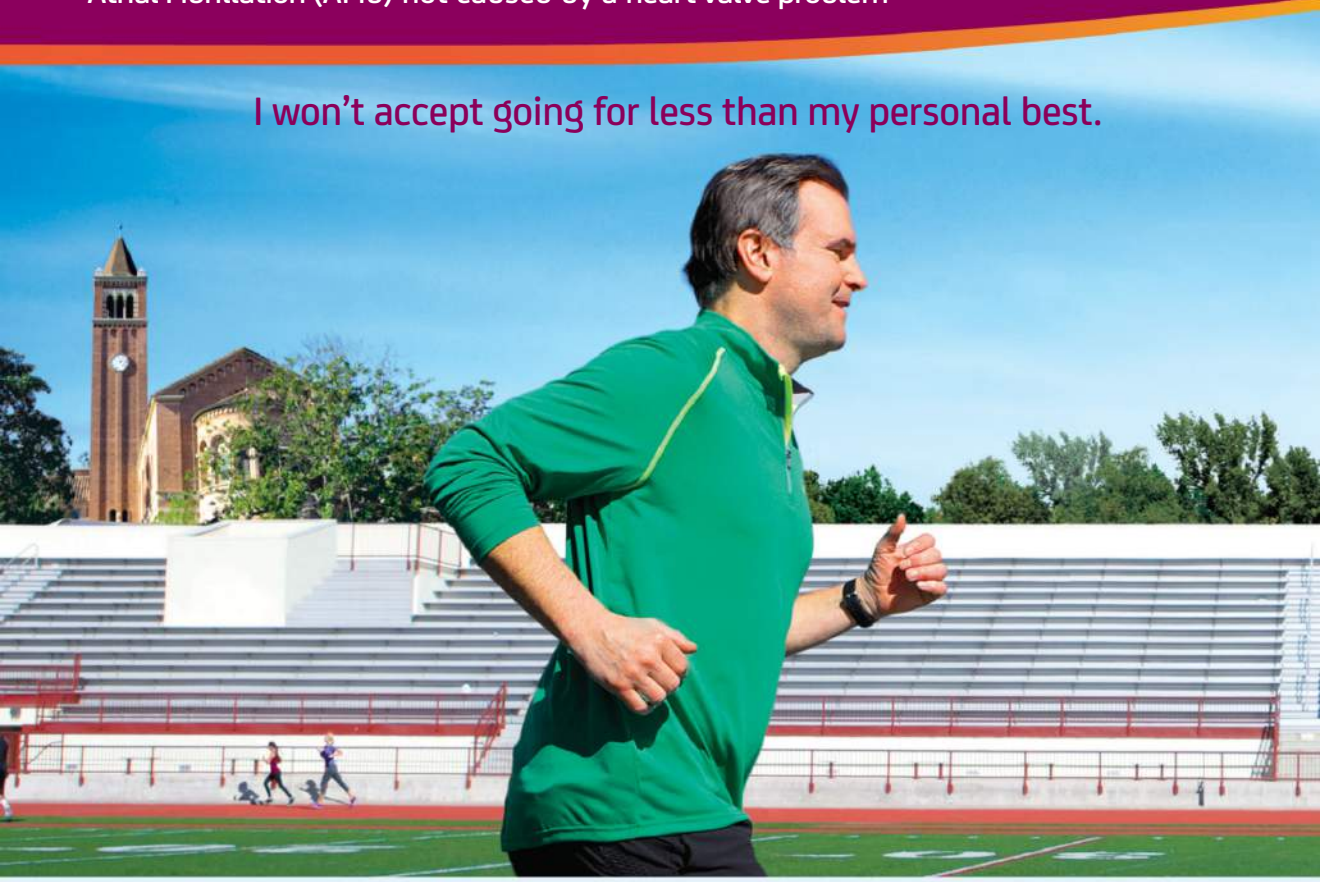
A novel storm formula is shedding new light on lightning. While researching cloud behavior, the University of California, Berkeley's David Romps and colleagues devised what they say is the most accurate model yet for predicting lightning strikes. Then they used that model to project how strikes will multiply—and how that could lead to more wildfires—if the planet continues to warm.

For a storm to produce the sudden electric discharge known as lightning, liquid water and ice, plus updrafts fast enough to keep both suspended, must be present. Romps theorized that by putting those factors into an equation, he could calculate how often lightning would strike. He multiplied the measured precipitation by the convective available potential energy, or how fast a storm cloud can rise. His calculations using 2011 data matched recorded lightning strikes 77 percent of the time. The conventional model was only 39 percent accurate.

The warmer the air is, the more storm-fueling water vapor it can hold. For every degree Celsius that the world warms, lightning strikes may increase about 12 percent in the U.S., Romps says. If carbon dioxide emissions continue at the current rate, that could mean 50 percent more lightning strikes by 2100. *—Lindsay N. Smith*

PHOTO: MICHAEL SHAINBLUM

For people with a higher risk of stroke due to
Atrial Fibrillation (AFib) not caused by a heart valve problem



ELIQUIS® (apixaban) is a prescription medicine used to reduce the risk of stroke and blood clots in people who have atrial fibrillation, a type of irregular heartbeat, not caused by a heart valve problem.

IMPORTANT SAFETY INFORMATION:

- **Do not stop taking ELIQUIS for atrial fibrillation without talking to the doctor who prescribed it for you. Stopping ELIQUIS increases your risk of having a stroke.** ELIQUIS may need to be stopped, prior to surgery or a medical or dental procedure. Your doctor will tell you when you should stop taking ELIQUIS and when you may start taking it again. If you have to stop taking ELIQUIS, your doctor may prescribe another medicine to help prevent a blood clot from forming.
- **ELIQUIS can cause bleeding, which can be serious,** and rarely may lead to death.
- **You may have a higher risk of bleeding if you take ELIQUIS and** take other medicines that increase your risk of bleeding, such as aspirin, NSAIDs, warfarin (COUMADIN®), heparin, SSRIs or SNRIs, and other blood thinners. **Tell your doctor about all medicines, vitamins and supplements you take.**

While taking ELIQUIS, you may bruise more easily and it may take longer than usual for any bleeding to stop.

- Get medical help right away if you have any of these signs or symptoms of bleeding:
  - unexpected bleeding, or bleeding that lasts a long time, such as unusual bleeding from the gums; nosebleeds that happen often, or menstrual or vaginal bleeding that is heavier than normal
  - bleeding that is severe or you cannot control
  - red, pink, or brown urine; red or black stools (looks like tar)
  - coughing up or vomiting blood or vomit that looks like coffee grounds
  - unexpected pain, swelling, or joint pain; headaches, feeling dizzy or weak
- **ELIQUIS is not for patients with artificial heart valves.**

Now I'm going for something better than warfarin. ELIQUIS.

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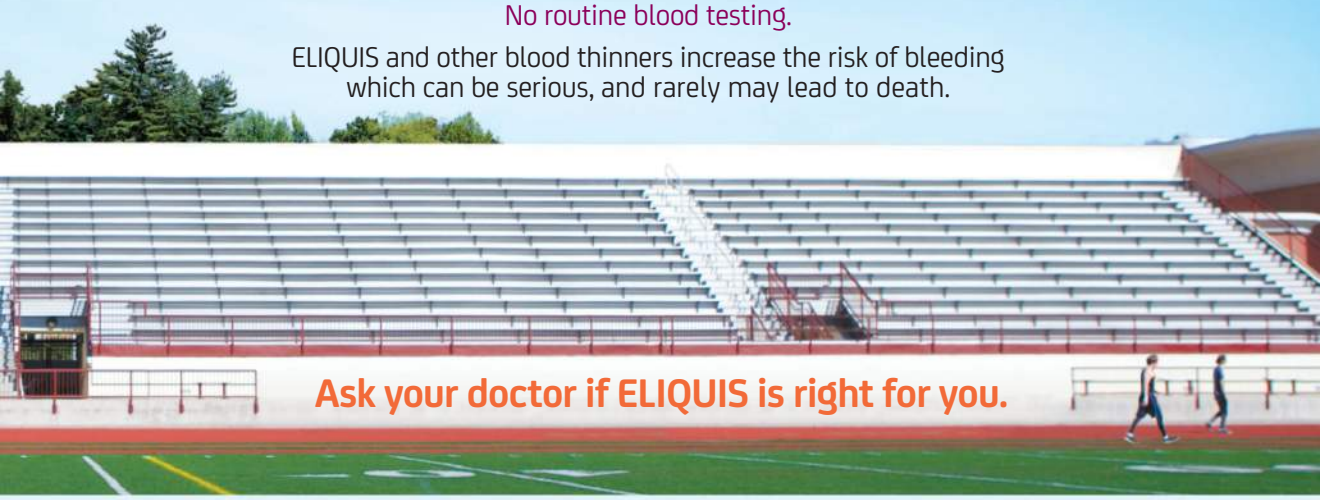
Reduced the risk of stroke better than warfarin.

Had less major bleeding than warfarin.

No routine blood testing.

ELIQUIS and other blood thinners increase the risk of bleeding which can be serious, and rarely may lead to death.



Ask your doctor if ELIQUIS is right for you.

- **Spinal or epidural blood clots (hematoma).** People who take ELIQUIS, and have medicine injected into their spinal and epidural area, or have a spinal puncture have a risk of forming a blood clot that can cause long-term or permanent loss of the ability to move (paralysis). This risk is higher if, an epidural catheter is placed in your back to give you certain medicine, you take NSAIDs or blood thinners, you have a history of difficult or repeated epidural or spinal punctures. Tell your doctor right away if you have tingling, numbness, or muscle weakness, especially in your legs and feet.
- **Before you take ELIQUIS,** tell your doctor if you have: kidney or liver problems, any other medical condition, or ever had bleeding problems. Tell your doctor if you are pregnant or breastfeeding, or plan to become pregnant or breastfeed.
- **Do not take ELIQUIS if you** currently have certain types of abnormal bleeding or have had a serious allergic reaction to ELIQUIS.

A reaction to ELIQUIS can cause hives, rash, itching, and possibly trouble breathing. Get medical help right away if you have sudden chest pain or chest tightness, have sudden swelling of your face or tongue, have trouble breathing, wheezing, or feeling dizzy or faint.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch, or call 1-800-FDA-1088.

Please see additional Important Product Information on the adjacent page.

Individual results may vary.

Learn about savings and offers.

Visit ELIQUIS.COM or call 1-855-ELIQUIS

Eliquis®
(apixaban) tablets 5mg 2.5mg

IMPORTANT FACTS about ELIQUIS® (apixaban) tablets

℞ ONLY

The information below does not take the place of talking with your healthcare professional. Only your healthcare professional knows the specifics of your condition and how ELIQUIS may fit into your overall therapy. Talk to your healthcare professional if you have any questions about ELIQUIS (pronounced ELL eh kwiss).

What is the most important information I should know about ELIQUIS (apixaban)?

For people taking ELIQUIS for atrial fibrillation: Do not stop taking ELIQUIS without talking to the doctor who prescribed it for you. Stopping ELIQUIS increases your risk of having a stroke. ELIQUIS may need to be stopped, prior to surgery or a medical or dental procedure. Your doctor will tell you when you should stop taking ELIQUIS and when you may start taking it again. If you have to stop taking ELIQUIS, your doctor may prescribe another medicine to help prevent a blood clot from forming.

ELIQUIS can cause bleeding which can be serious, and rarely may lead to death. This is because ELIQUIS is a blood thinner medicine that reduces blood clotting.

You may have a higher risk of bleeding if you take ELIQUIS and take other medicines that increase your risk of bleeding, such as aspirin, nonsteroidal anti-inflammatory drugs (called NSAIDs), warfarin (COUMADIN®), heparin, selective serotonin reuptake inhibitors (SSRIs) or serotonin norepinephrine reuptake inhibitors (SNRIs), and other medicines to help prevent or treat blood clots.

Tell your doctor if you take any of these medicines. Ask your doctor or pharmacist if you are not sure if your medicine is one listed above.

While taking ELIQUIS:

- you may bruise more easily
- it may take longer than usual for any bleeding to stop

Call your doctor or get medical help right away if you have any of these signs or symptoms of bleeding when taking ELIQUIS:

- unexpected bleeding, or bleeding that lasts a long time, such as:
  - unusual bleeding from the gums
  - nosebleeds that happen often
  - menstrual bleeding or vaginal bleeding that is heavier than normal
- bleeding that is severe or you cannot control
- red, pink, or brown urine
- red or black stools (looks like tar)
- cough up blood or blood clots
- vomit blood or your vomit looks like coffee grounds
- unexpected pain, swelling, or joint pain
- headaches, feeling dizzy or weak

ELIQUIS (apixaban) is not for patients with artificial heart valves.

Spinal or epidural blood clots (hematoma). People who take a blood thinner medicine (anticoagulant) like ELIQUIS, and have medicine injected into their spinal and epidural area, or have a spinal puncture have a risk of forming a blood clot that can cause long-term or permanent loss of the ability to move (paralysis). Your risk of developing a spinal or epidural blood clot is higher if:

- a thin tube called an epidural catheter is placed in your back to give you certain medicine
- you take NSAIDs or a medicine to prevent blood from clotting
- you have a history of difficult or repeated epidural or spinal punctures
- you have a history of problems with your spine or have had surgery on your spine

If you take ELIQUIS and receive spinal anesthesia or have a spinal puncture, your doctor should watch you closely for symptoms of spinal or epidural blood clots or bleeding. Tell your doctor right away if you have tingling, numbness, or muscle weakness, especially in your legs and feet.

What is ELIQUIS?

ELIQUIS is a prescription medicine used to:

- reduce the risk of stroke and blood clots in people who have atrial fibrillation.
- reduce the risk of forming a blood clot in the legs and lungs of people who have just had hip or knee replacement surgery.

(Continued on adjacent page)

- treat blood clots in the veins of your legs (deep vein thrombosis) or lungs (pulmonary embolism), and reduce the risk of them occurring again.

It is not known if ELIQUIS is safe and effective in children.

Who should not take ELIQUIS (apixaban)?

Do not take ELIQUIS if you:

- currently have certain types of abnormal bleeding
- have had a serious allergic reaction to ELIQUIS. Ask your doctor if you are not sure

What should I tell my doctor before taking ELIQUIS?

Before you take ELIQUIS, tell your doctor if you:

- have kidney or liver problems
- have any other medical condition
- have ever had bleeding problems
- are pregnant or plan to become pregnant. It is not known if ELIQUIS will harm your unborn baby
- are breastfeeding or plan to breastfeed. It is not known if ELIQUIS passes into your breast milk. You and your doctor should decide if you will take ELIQUIS or breastfeed. You should not do both

Tell all of your doctors and dentists that you are taking ELIQUIS. They should talk to the doctor who prescribed ELIQUIS for you, before you have **any** surgery, medical or dental procedure. **Tell your doctor about all the medicines you take, including** prescription and over-the-counter medicines, vitamins, and herbal supplements. Some of your other medicines may affect the way ELIQUIS works. Certain medicines may increase your risk of bleeding or stroke when taken with ELIQUIS.

How should I take ELIQUIS?

Take ELIQUIS exactly as prescribed by your doctor. Take ELIQUIS twice every day with or without food, and do not change your dose or stop taking it unless your doctor tells you to. If you miss a dose of ELIQUIS, take it as soon as you remember, and do not take more than one dose at the same time. **Do not run out of ELIQUIS. Refill your prescription before you run out.** When leaving the hospital following hip or knee replacement, be sure that you will have ELIQUIS (apixaban) available to avoid missing any doses. **If you are taking ELIQUIS for atrial fibrillation, stopping ELIQUIS may increase your risk of having a stroke.**

What are the possible side effects of ELIQUIS?

- See **"What is the most important information I should know about ELIQUIS?"**
- ELIQUIS can cause a skin rash or severe allergic reaction. Call your doctor or get medical help right away if you have any of the following symptoms:
  - chest pain or tightness
  - swelling of your face or tongue
  - trouble breathing or wheezing
  - feeling dizzy or faint

Tell your doctor if you have any side effect that bothers you or that does not go away.

These are not all of the possible side effects of ELIQUIS. For more information, ask your doctor or pharmacist.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

This is a brief summary of the most important information about ELIQUIS. For more information, talk with your doctor or pharmacist, call 1-855-ELIQUIS (1-855-354-7847), or go to www.ELIQUIS.com.

Manufactured by:

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and

Pfizer Inc
New York, New York 10017 USA

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August 2014

432US14BR00770-09-01

Watson, age six, recently helped Maryland police find a missing student.

Dogged Pursuit

When it comes to crime solving, the bloodhound is such a pro its evidence is admissible in U.S. courts. Classified as a scent hound—as opposed to a sight hound, a fast dog that tracks prey visually—the bloodhound has a uniquely powerful **NOSE** that's been put to use trailing missing people and criminals for centuries. Its olfactory membrane is, by some estimates, 40 times as large as a human's. Its loose facial skin, including the pendulous **FLEWS** and **DEWLAP,** droopy ears, and abundant slobber all help a hound "hoover up" odor molecules, says Lisa Harvey, a biologist at Victor Valley College in California.

Veteran hounds can track a person's two-day-old scent through crowds, wind, and rain. But they can be stumped. "They can't always tell the difference between identical twins," says Harvey, whose research suggests that the dogs may be sniffing something related to a person's genetics. A human scent, says National Police Bloodhound Association President Doug Lowry, "is like a fingerprint to them." *—Eve Conant*

PHOTO: REBECCA HALE, NGM STAFF

PETS CHANGE LIVES

Pit Bulls Become Shelter Stars

Combining innovative thinking, pet behavioral science, and smart marketing, the Nebraska Humane Society (NHS) managed to reverse what could have been a serious ban on pit bulls and other so-called "bully breeds." Denise Gurss, Director of Shelter Training and Behavior, said, "A lot of people hear 'pit bull' and think 'dangerous.' So we created the Breed Ambassador program." **Since launching the initiative in compliance with the city's Breed Specific Ordinance in 2009, the shelter has facilitated hundreds of adoptions—and proven that these dogs can be exceptional companions.**

NHS covers all the bases. "Initially, our animal control officers talk to people on the street with 'pitties'" and make sure they understand the ordinance, which mandates that their pets be leashed, wear a muzzle, and be controlled by an adult over 19 when out in public," said Denise. When a dog comes through for adoption, they provide "basic manners" training and all required equipment. "It's wonderful Purina ONE is involved, providing food for all dogs in the shelter," she said. "Adopted dogs are also sent home with a supply, setting a high standard of nutrition."

The centerpiece of the program is the Breed Ambassador training. All "bully breeds" are eligible for free obedience classes over six weeks that enable them to take a Canine Good Citizen test, developed by the American Kennel Club. Dogs that pass are issued a Breed Ambassador vest and can go out without a muzzle. Carol Knoepfler, a longtime NHS volunteer with four adopted dogs, chose to make pit bull Pearl her fifth so that she could help transform her into a Breed Ambassador and "make a difference," said Carol. "When she came to the shelter, she was very stressed out, but her nature was gentle and loving." Pearl even "mothered some orphan kittens" that Carol fostered.

To help promote the breed, she takes Pearl, proudly wearing the vest, with her all over town—to the law school where she teaches, to parades, to an elementary school class—all to demonstrate that this breed makes "fabulous pets," she said. "In many instances it's the first pit bull they've met." Carol is a true believer: "You'd never know how soft, sweet, and cuddly pit bulls are until you get to know them. And once you know one, you're a Breed Ambassador, too!"

A Climate for Coffee

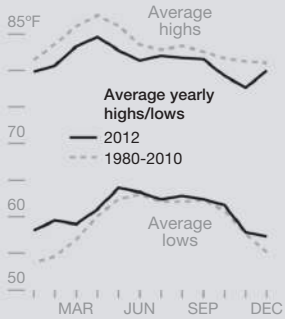
By 2050 climate change could halve the land that's suitable for growing coffee—one of the world's most valuable traded commodities, with some 100 million people economically dependent on the industry. As climate zones shift, new areas may have the right growing conditions, but the land may be forested or otherwise unavailable.

Rising temperatures also make plants more susceptible to disease. Developing resistant plant varieties could limit crop losses, says David Laughlin of World Coffee Research. But because the plant hasn't been well researched, a solution could take time to brew. *—Kelsey Nowakowski*

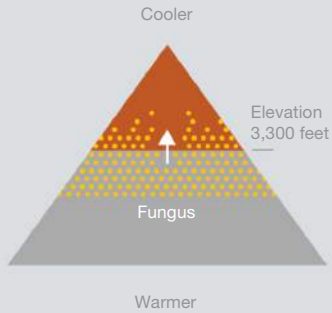
COFFEE RUST IN CENTRAL AMERICA

This fungal disease has long attacked coffee plants at lower altitudes. Now shifting temperatures are letting it climb to higher altitudes, where premium coffee grows.

AS TEMPERATURE RANGES NARROW ON GUATEMALAN COFFEE FARMS…



RUST CAN GROW AT HIGHER ALTITUDES.



THE DAMAGE

The fungus invades through the stomata, natural openings on the underside of a leaf.

It then attacks the leaves, causing chlorosis, also known as yellowing.

Infected leaves develop pustules, which release spores that can infect other leaves or plants.

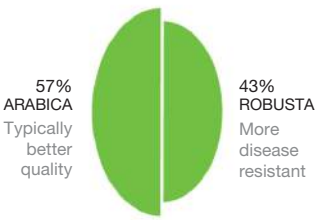
Damaged leaves drop prematurely, reducing the plant's photosynthesis and yield.

THE GLOBAL COFFEE ECONOMY

52

MILLION POUNDS OF COFFEE ARE CONSUMED EACH DAY.

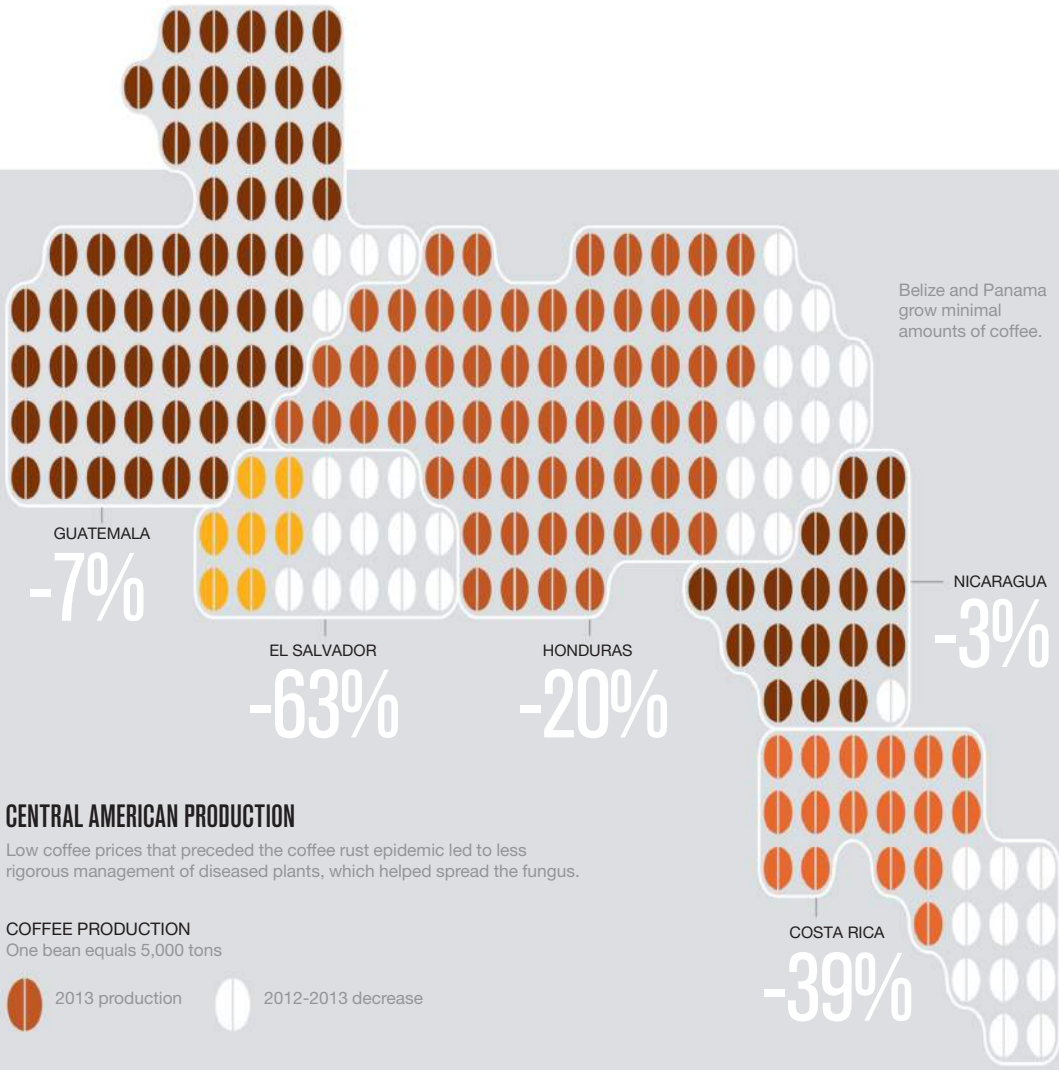
PRODUCTION BY VARIETY



COFFEE GROWERS

Coffee is exported by more than 50 countries.

Brazil and Vietnam account for more than half the world's production.



CENTRAL AMERICAN PRODUCTION

Low coffee prices that preceded the coffee rust epidemic led to less rigorous management of diseased plants, which helped spread the fungus.

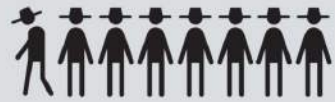
COFFEE PRODUCTION
One bean equals 5,000 tons

2013 production

2012-2013 decrease

234,400

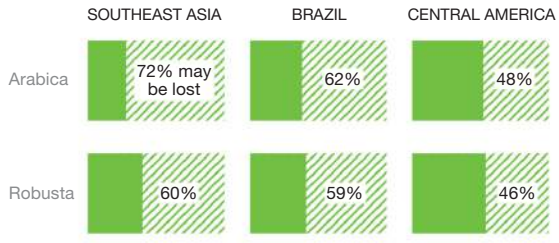
JOBS WERE LOST TO COFFEE RUST IN THE 2012-2013 GROWING SEASON.



That equals 12 percent of the 1.9 million-person workforce.

COFFEE CROPLAND LOST BY 2050

Coffee can grow only within a narrow temperature range, so suitable land could shrink in many regions by 2050. These three areas produce 71 percent of the current crop.



-50%

REDUCTION IN AREA SUITABLE FOR GROWING COFFEE BY 2050

GRAPHIC: ÁLVARO VALIÑO. SOURCES: WORLD COFFEE RESEARCH; FAO; INTERNATIONAL COFFEE ORGANIZATION; C. BUNN, CIAT, COLOMBIA; SELENA GEORGIOU AND PABLO IMBACH, CATIE; JACQUES AVELINO, CIRAD/CATIE

EXPLORE
Nat Geo Wild

How a Jellyfish Re-arms

Many invertebrates, such as salamanders and sea stars, can regrow a body part if they lose one. That's what biologist Michael Abrams expected to happen when he removed two of eight arms from a young moon jelly *(Aurelia aurita).* But when Abrams checked on the experiment, "he started yelling…'You won't believe this—you've got to come here and see!' " recalls Abrams's doctoral adviser, Lea Goentoro of Caltech in Pasadena. Instead of regrowing limbs, the jellyfish had rearranged its remaining arms so they were spaced equidistantly around its body.

For a young moon jelly, or an adult (below), being symmetrical is crucial for movement and feeding. For Abrams's test animal to achieve that, muscles contracted in its body, which pushed and pulled the remaining arms until they were once again evenly spaced. The scientists had stumbled upon a phenomenon completely new to science, which they call "symmetrization." It's clearly an important way in which jellyfish heal themselves—and, says Goentoro, it could prove useful to scientists studying regenerative mechanisms. *—Carrie Arnold*

LEARN MORE ABOUT OCEANS In his new book, *Pristine Seas: Journeys to the Ocean's Last Wild Places,* National Geographic Explorer-in-Residence Enric Sala takes readers to ten of the last wild places in Earth's oceans. The book goes on sale September 22 wherever books are sold and at *shopng.com/books.* On television, the latest Pristine Seas adventure, *Behind Russia's Frozen Curtain,* premieres on the Nat Geo WILD channel on Sunday, September 20 at 9 p.m. ET.

PHOTO: ALEXANDER SEMENOV

FOR SOME PATIENTS, LYRICA CAN PROVIDE SIGNIFICANT RELIEF FROM DIABETIC NERVE PAIN.*

*Individual results may vary.

Prescription LYRICA is not for everyone. Tell your doctor right away about any serious allergic reaction that causes swelling of the face, mouth, lips, gums, tongue, throat, or neck or any trouble breathing, rash, hives or blisters. LYRICA may cause suicidal thoughts or actions in a very small number of people. Patients, family members or caregivers should call the doctor right away if they notice suicidal thoughts or actions, thoughts of self harm, or any unusual changes in mood or behavior. These changes may include new or worsening depression, anxiety, restlessness, trouble sleeping, panic attacks, anger, irritability, agitation, aggression, dangerous impulses or violence, or extreme increases in activity or talking. If you have suicidal thoughts or actions, do not stop LYRICA without first talking to your doctor. LYRICA may cause swelling of your hands, legs and feet. Some of the most common side effects of LYRICA are dizziness and sleepiness. Do not drive or work with machines until you know how LYRICA affects you. Other common side effects are blurry vision, weight gain, trouble concentrating, dry mouth, and feeling "high." Also, tell your doctor right away about muscle pain along with feeling sick and feverish, or any changes in your eyesight including blurry vision or any skin sores if you have diabetes. You may have a higher chance of swelling, hives or gaining weight if you are also taking certain diabetes or high blood pressure medicines. Do not drink alcohol while taking LYRICA. You may have more dizziness and sleepiness if you take LYRICA with alcohol, narcotic pain medicines, or medicines for anxiety. If you have had a drug or alcohol problem, you may be more likely to misuse LYRICA. Tell your doctor if you are planning to father a child. Talk with your doctor before you stop taking LYRICA or any other prescription medication.

Please see Important Risk Information for LYRICA on the following page.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

Ask your doctor about LYRICA and visit **LYRICA.com** or call **1-888-9-LYRICA (1-888-959-7422).**

LYRICA® PREGABALIN © capsules

IT'S SPECIFIC TREATMENT FOR DIABETIC NERVE PAIN

IMPORTANT FACTS

LYRICA® PREGABALIN © capsules (**LEER**-i-kah)

IMPORTANT SAFETY INFORMATION ABOUT LYRICA

LYRICA may cause serious, even life threatening, allergic reactions.
Stop taking LYRICA and call your doctor right away if you have any signs of a serious allergic reaction:
- Swelling of your face, mouth, lips, gums, tongue, throat or neck
- Have any trouble breathing
- Rash, hives (raised bumps) or blisters

Like other antiepileptic drugs, LYRICA may cause suicidal thoughts or actions in a very small number of people, about 1 in 500.
Call your doctor right away if you have any symptoms, especially if they are new, worse or worry you, including:
- suicidal thoughts or actions
- new or worse depression
- new or worse anxiety
- feeling agitated or restless
- panic attacks
- trouble sleeping
- new or worse irritability
- acting aggressive, being angry, or violent
- acting on dangerous impulses
- an extreme increase in activity and talking
- other unusual changes in behavior or mood

If you have suicidal thoughts or actions, do not stop LYRICA without first talking to your doctor.

LYRICA may cause swelling of your hands, legs and feet.
This swelling can be a serious problem with people with heart problems.

LYRICA may cause dizziness or sleepiness.
Do not drive a car, work with machines, or do other dangerous things until you know how LYRICA affects you. Ask your doctor when it is okay to do these things.

ABOUT LYRICA

LYRICA is a prescription medicine used in adults 18 years and older to treat:
- Pain from damaged nerves that happens with diabetes or that follows healing of shingles, or spinal cord injury
- Partial seizures when taken together with other seizure medicines
- Fibromyalgia (pain all over your body)

Who should NOT take LYRICA:
- Anyone who is allergic to anything in LYRICA

BEFORE STARTING LYRICA

Tell your doctor about all your medical conditions, including if you:
- Have had depression, mood problems or suicidal thoughts or behavior
- Have or had kidney problems or dialysis
- Have heart problems, including heart failure
- Have a bleeding problem or a low blood platelet count
- Have abused prescription medicines, street drugs or alcohol in the past
- Have ever had swelling of your face, mouth, tongue, lips, gums, neck, or throat (angioedema)
- Plan to father a child. It is not known if problems seen in animal studies can happen in humans.
- Are pregnant, plan to become pregnant or are breastfeeding. It is not known if LYRICA will harm your unborn baby. You and your doctor should decide whether you should take LYRICA or breast-feed, but you should not do both.

Tell your doctor about all your medicines. Include over-the-counter medicines, vitamins, and herbal supplements. LYRICA and other medicines may affect each other causing side effects. Especially tell your doctor if you take:

BEFORE STARTING LYRICA, continued

- Angiotensin converting enzyme (ACE) inhibitors. You may have a higher chance for swelling and hives.
- Avandia® (rosiglitazone)*, Avandamet® (rosiglitazone and metformin)* or Actos® (pioglitazone)** for diabetes. You may have a higher chance of weight gain or swelling of your hands or feet.
- Narcotic pain medicines (such as oxycodone), tranquilizers or medicines for anxiety (such as lorazepam). You may have a higher chance for dizziness and sleepiness.
- Any medicines that make you sleepy.

POSSIBLE SIDE EFFECTS OF LYRICA

LYRICA may cause serious side effects, including:
- See "Important Safety Information About LYRICA."
- Muscle problems, pain, soreness or weakness along with feeling sick and fever
- Eyesight problems including blurry vision
- Weight gain. Weight gain may affect control of diabetes and can be serious for people with heart problems.
- Feeling "high"

If you have any of these symptoms, tell your doctor right away.

The most common side effects of LYRICA are:
- Dizziness
- Blurry vision
- Weight gain
- Sleepiness
- Trouble concentrating
- Swelling of hands and feet
- Dry mouth

If you have diabetes, you should pay extra attention to your skin while taking LYRICA.

HOW TO TAKE LYRICA

Do:
- Take LYRICA exactly as your doctor tells you. Your doctor will tell you how much to take and when to take it. Take LYRICA at the same times each day.
- Take LYRICA with or without food.

Don't:
- Drive a car or use machines if you feel dizzy or sleepy while taking LYRICA.
- Drink alcohol or use other medicines that make you sleepy while taking LYRICA.
- Change the dose or stop LYRICA suddenly. If you stop taking LYRICA suddenly, you may have headaches, nausea, diarrhea, trouble sleeping, increased sweating, or you may feel anxious. If you have epilepsy, you may have seizures more often.
- Start any new medicines without first talking to your doctor.

NEED MORE INFORMATION?

- Ask your doctor or pharmacist. This is only a brief summary of important information.
- Go to **www.lyrica.com** or call **1-866-459-7422 (1-866-4LYRICA).**

PARKE–DAVIS, Division of Pfizer Inc., New York, NY 10017

Version September 2014

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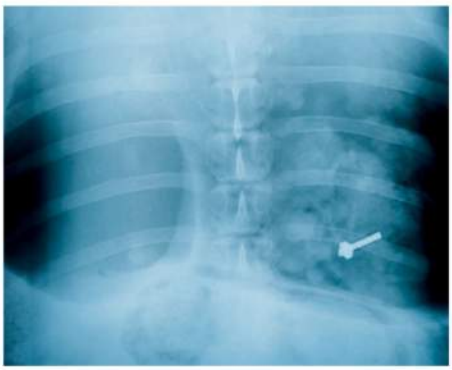
Shot to the Stomach

Most people prefer swallowing a pill to being poked with a needle. But pills aren't perfect. Intravenous injections get medicine to the bloodstream faster, and some protein-based drugs—insulin, for instance—can't be taken orally. The stomach starts digesting them before they can be absorbed.

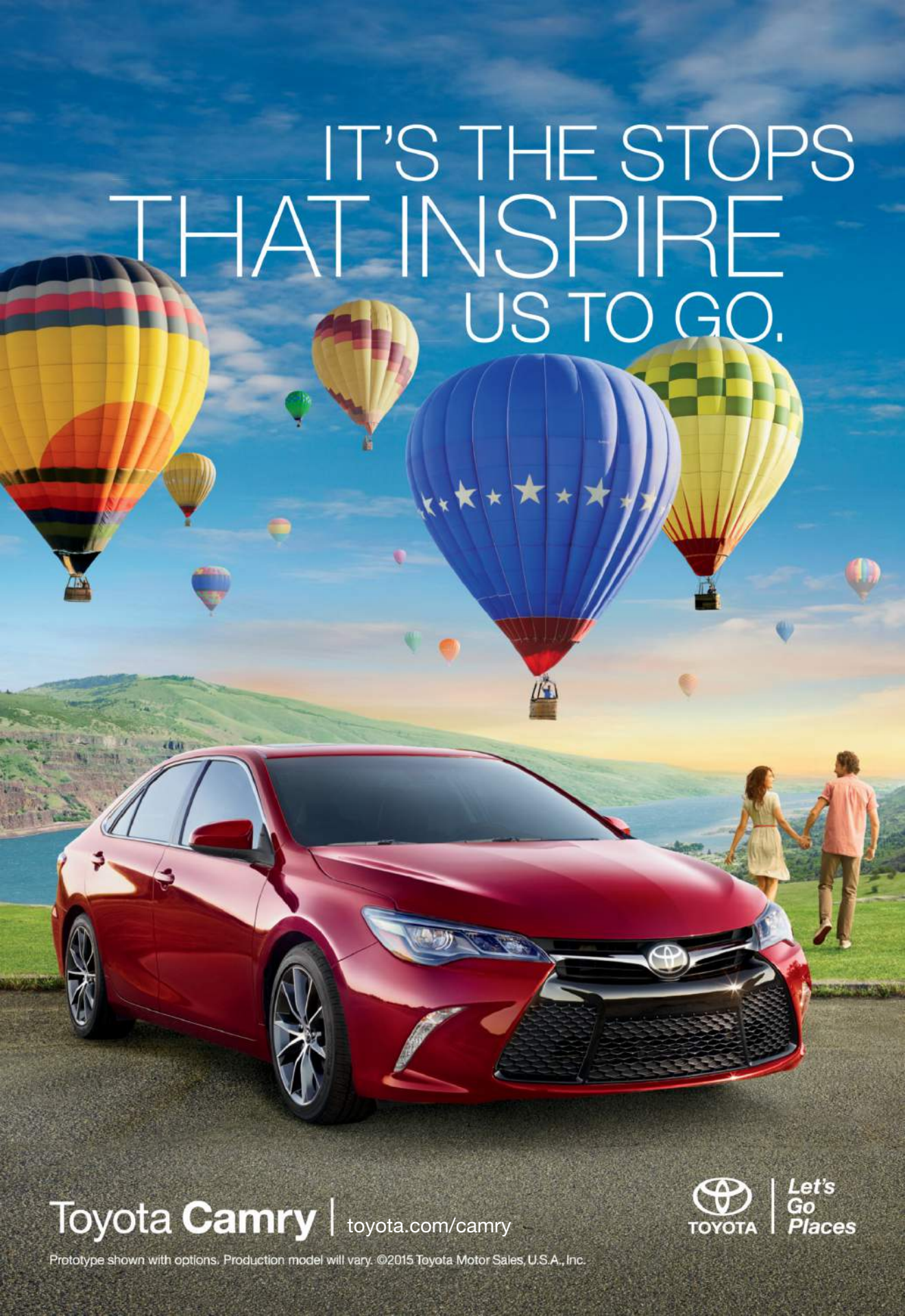
Now researchers have come up with a better way for you to take your medicine: Swallow the needle. From the outside, this new pill "looks like any other multivitamin," says chemical engineer Carl M. Schoellhammer, "but once it reaches the stomach, the outer coating dissolves, and it reveals the needles." The stainless steel needles, one-twentieth of an inch long, release the drug when they penetrate the lining of the gastrointestinal tract.

Don't worry, you won't feel a thing. The GI tract doesn't register pain. And at a bit more than three-quarters of an inch long, this capsule is small enough to travel through the tract. So far the pill has been tested only on animals, with no signs of pain or injury. But passing the pill is slow going: It took at least seven days for it to exit a test subject's body. *—Rachel Hartigan Shea*



The microneedle pill looks prickly without its coating (top, shown to scale) and in an x-ray, but patients won't feel it.

PHOTOS, FROM TOP: REBECCA HALE, NGM STAFF; CARL SCHOELLHAMMER AND GIOVANNI TRAVERSO, MASSACHUSETTS GENERAL HOSPITAL/HARVARD MEDICAL SCHOOL/MIT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TOYOTA | Let's Go Places
Prototype shown with options. Production model will vary. ©2015 Toyota Motor Sales, U.S.A., Inc.

When Looks Deceive

As might be true in any big family, the Galloanserae clan has some gorgeous and some plain-looking members, some promiscuous and some monogamous ones. The avian superorder includes common pheasants, peacocks, and swans among the 452 species of game and water fowl. But the most colorful and randy Galloanserae males may not be passing on the best genes to offspring, according to a recent study.

"There have been lots of theories that the ornaments, the beautiful colors and big tails, are sported by the most fit males," says evolutionary biologist Judith Mank of University College London. "We were explicitly testing that theory" in the study, published in the *Proceedings of the National Academy of Sciences*.

Mank and her colleagues analyzed genetic materials from six species of birds of both dispositions. In the flashy birds they found a rapidly evolving genome marked by mild gene mutations; in the drab ones they didn't find that. When females mate with flashy males, genetic flaws are passed on that may affect the species' prospects in the future.

The study confirmed that "there's no link between flashiness and fitness," says Mank. "A male may be attractive, but he doesn't deliver at the genetic level. In a way, it's false advertising." *—Patricia Edmonds*

HABITAT/RANGE
Farms and grasslands in North America, Europe, and Asia

CONSERVATION STATUS
Least concern

OTHER FACTS
The common pheasant belongs to a bird superorder that dates back 90 million years.

A promiscuous, flashy male may attract females, "but he doesn't deliver at the genetic level."

These male common pheasants *(Phasianus colchicus)* were photographed at Cammack Gamebird Farm, in DeWitt, Nebraska.

PHOTO: JOEL SARTORE

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VISIONS

Brazil
On the Brazil-Argentina border, a blizzard of butterflies descends on the banks of the Iguaçu River. Mineral-rich ponds that form when the river is low attract these pierids, which absorb water and secrete the excess—a process known as puddling.

PHOTO: DANIEL PINHEIRO

India
Dusted in yellow-green powder, five villagers in Nandgaon celebrate Lathmar Holi, a playful, pre-Holi festival rooted in Hindu mythology. The annual two-day event includes mock altercations between the men and women of two villages.

PHOTO: MANISH SWARUP, AP IMAGES

United States
Like pasta boiling in a pot, four-inch-long American eels bound for Asian fish markets wriggle in a glass dish. This species—spawned in the Sargasso Sea and swept to Maine by the Gulf Stream—lives most of its life in freshwater.

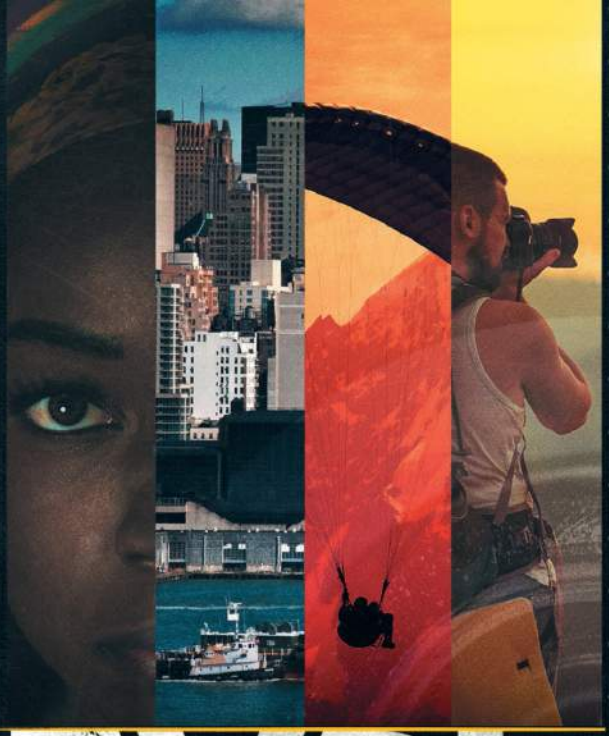
PHOTO: HEATHER PERRY

Best in Show

People from 135 countries submitted more than 9,000 images to last year's National Geographic Photography Contest, our annual collection of readers' top shots judged by the magazine's photo editors and photographers. The judges selected winners in the categories of People (this page), Places, and Nature (next page). The winning images convey a sense of place and time, capturing unique moments in inventive ways. "They were layered and nuanced and invited the viewer to think," says Monica Corcoran, director of both the photo contest and the Your Shot community. For the photo below, grand-prize winner Brian Yen received $10,000 and a trip to National Geographic's headquarters in Washington, D.C.

To enter this year's contest, go to *ngphotocontest.com.*

PEOPLE **Brian Yen** *Hong Kong, China*
On a hot day in Hong Kong, people crowded into an air-conditioned train. When the lights dimmed, one young woman stood out, lost in the glow of her own digital world.



THE GROUNDBREAKING ORIGINAL SERIES RETURNS TO TELEVISION

EXPLORER

PREMIERE EPISODE

WARLORDS OF IVORY

Investigating the blood, crime, and terror behind the black market ivory trade.

SUNDAY AUGUST 30

8/7c

NATIONAL GEOGRAPHIC CHANNEL

natgeotv.com/Explorer

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LEGAL NOTICE

If you purchased the muscle relaxant Skelaxin or generic metaxalone, your rights may be affected by and you could get a payment from a class action settlement.

A settlement has been reached with Mutual Pharmaceutical Company, Inc. ("Mutual") in a class action lawsuit about whether Mutual and King Pharmaceuticals, Inc. ("King") acted unlawfully to keep generic versions of Skelaxin off the market. Mutual denies all of the claims in the lawsuit, but has agreed to the settlement to avoid the cost and risk of a trial. The lawsuit is not proceeding against King.

Who's Included? The settlement includes people and entities in the U.S. or its territories who purchased, paid for or reimbursed some or all of the purchase price of Skelaxin or its AB-rated generic equivalent (metaxalone) at retail or mail order pharmacies located in AZ, AR, CA, FL, IA, KS, ME, MA, MI, MN, MS, MO, NE, NV, NM, NY, NC, ND, OR, PA, RI, SC, SD, TN, VT, VA, WV, WI, or Washington, D.C., in any form, for personal or family use, or for their members, employees, insureds, participants, or beneficiaries, other than for resale, between November 4, 2005 and August 5, 2014 ("Settlement Class Members"). There are two groups included in the settlement: consumers and third party payors ("TPPs"). If you are a consumer and your insurance plan requires you to pay a flat co-payment (the same amount for Skelaxin and generic metaxalone), you are *not* included in the settlement.

What Does the Settlement Provide? A $9 million Settlement Fund has been established by Mutual. After the deducting Plaintiffs' Class Counsel attorneys' fees and expenses and the costs of settlement notice and administration, 28% of the net the Settlement Fund will be made available to consumers and 72% will be made available to TPPs. Payments will be based on the qualifying amount of Skelaxin or generic metaxalone purchased, the amount paid for those purchases and the total amount of purchases claimed. Consumers will receive their share of the consumer portion of the net Settlement Fund in proportion to their qualifying purchases.

How Do You Get a Payment? You must submit a claim form by **October 31, 2015**. Claims may be submitted online or downloaded for mailing at www.skelaxinsettlement.com. Claim forms and instructions are also available by calling 1-866-267-0396 or by writing to *In re Skelaxin (Metaxalone)Antitrust Litigation*, PO Box 43278, Providence, Rhode Island 02940-3278.

Your Other Options. If you are included in the settlement class and you do nothing you do nothing, your rights will be affected and you won't get a payment. If you don't want to be legally bound by the settlement, you must exclude yourself from it by **September 28, 2015**. Unless you exclude yourself, you won't be able to sue or continue to sue Mutual for any claim made in this lawsuit or released by the Settlement Agreement. If you stay in the settlement (*i.e.*, don't exclude yourself), you may object to it or ask for permission for you or your own lawyer to appear and speak at the hearing—at your own cost—but you don't have to. Objections and requests to appear are due by **September 28, 2015**. More information about these options is in the detailed notice available at www.skelaxinsettlement.com.

The Court will hold a hearing in this case (*In re Skelaxin (Metaxalone) Antitrust Litigation*, MDL No. 1:12-md-2343) on November 2, 2015 to consider whether to approve the settlement and Plaintiffs' Class Counsel attorneys' fees of up to 33 1/3% of the Settlement Fund, plus reasonable costs and expenses. If approved, these fees, costs and expenses will be paid from the Settlement Fund before making payments to Settlement Class Members.

1-866-267-0396 **www.skelaxinsettlement.com**

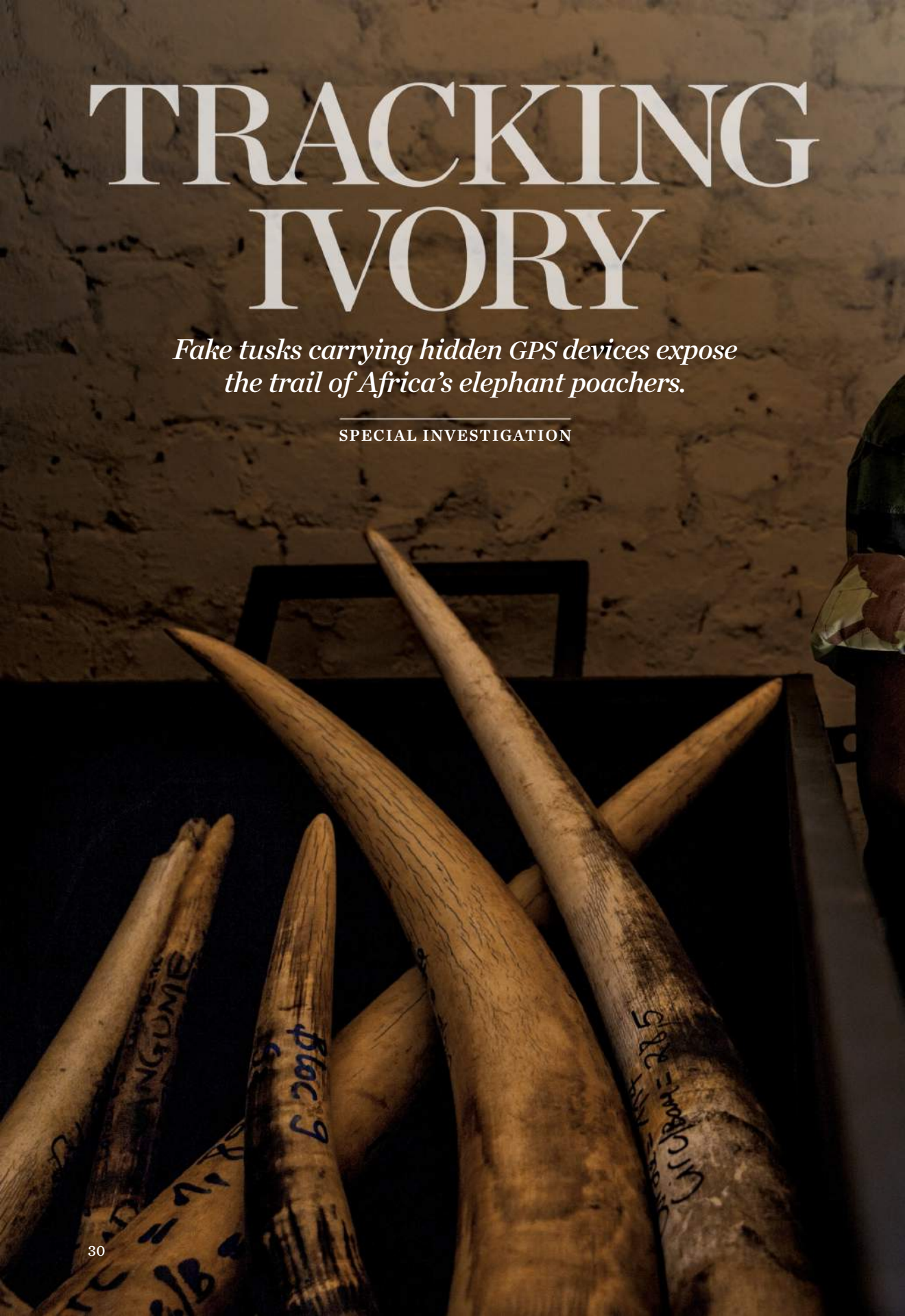
PLACES **Triston Yeo** *Singapore*
Yeo was in Budapest teaching a photography clinic. At a spa, he chose to use a mesh curtain rather than push his lens through it. “The finished photo has a sense of voyeurism,” he says.

NATURE **Nicole Cambré** *Brussels, Belgium*
Traveling on the Tanzanian side of the northern Serengeti, Cambré watched a group of wildebeests methodically cross the Mara River. While others waited, one wildebeest leaped.

TRACKING IVORY

Fake tusks carrying hidden GPS devices expose the trail of Africa's elephant poachers.

SPECIAL INVESTIGATION



Veteran ranger Jean Claude Mambo Marindo sits beside almost a hundred tusks seized from elephant poachers at Garamba National Park, in the Democratic Republic of the Congo. The park has lost all its rhinos to poaching for their horns. Now it's under siege for its ivory, mainly by rogue soldiers from national armies and by the terrorist group the Lord's Resistance Army (LRA).

Rangers practice their riding skills at Zakouma National Park, in Chad. The park has four mounted ranger teams because horses are the only way to effectively patrol during the wet season, when the elephants head to drier land outside the park.

Ugandan soldiers with the African Union's Regional Task Force hunt for LRA leader Joseph Kony in the Central African Republic (CAR), pulling themselves along ropes to cross rivers. Kony's men jump back and forth across borders, hiding in countries where governance is weak.

By Bryan Christy • Photographs by Brent Stirton

When the American Museum of Natural History wanted to update the hall of North American mammals, taxidermist George Dante got the call. When the tortoise Lonesome George, emblem of the Galápagos Islands, died, it was Dante who was tasked with restoring him. But Dante, who is one of the world's most respected taxidermists, has never done what I'm asking him to do. No one has.

A National Geographic Special Investigation
This story launches the National Geographic Society's Special Investigations Unit, which will report on wildlife crimes. This project was made possible by a grant from The Woodtiger Fund.

I want Dante to design an artificial elephant tusk that has the look and feel of confiscated tusks loaned to me by the U.S. Fish and Wildlife Service. Inside the fake tusk, I want him to embed a custom-made GPS and satellite-based tracking system. If he can do this, I'll ask him to make several more tusks. In the criminal world, ivory operates as currency, so in a way I'm asking Dante to print counterfeit money I can follow.

I will use his tusks to hunt the people who kill elephants and to learn what roads their ivory plunder follows, which ports it leaves, what ships it travels on, what cities and countries it transits, and where it ends up. Will artificial tusks planted in a central African country head east—or west—toward a coast with reliable transportation to Asian markets? Will they go north, the most

J. MICHAEL FAY, WILDLIFE CONSERVATION SOCIETY

In May 2013 poachers with the insurgent group Seleka massacred 26 elephants at Dzanga Bai, a mineral-rich watering hole in CAR.

violent ivory path on the African continent? Or will they go nowhere, discovered before they're moved and turned in by an honest person?

As we talk over my design needs, Dante's brown eyes sparkle like a boy's on Christmas morning. To test ivory, dealers will scratch a tusk with a knife or hold a lighter under it; ivory is a tooth and won't melt. My tusks will have to act like ivory. "And I gotta find a way to get that shine," Dante says, referring to the gloss a clean elephant tusk has.

"I need Schreger lines too, George," I say, referring to the cross-hatching on the butt of a sawn tusk that looks like growth rings of a tree trunk.

Like much of the world, George Dante knows that the African elephant is under siege. A booming Chinese middle class with an insatiable taste for ivory, crippling poverty in Africa, weak and corrupt law enforcement, and more ways than ever to kill an elephant have created a perfect storm. The result: Some 30,000 African elephants are slaughtered every year, more than 100,000 between 2009 and 2012, and the pace of killing is not slowing. Most illegal ivory goes to China, where a pair of ivory chopsticks can bring more than a thousand dollars and carved tusks sell for hundreds of thousands of dollars.

East Africa is now ground zero for much of the poaching. In June the Tanzanian government announced that the country has lost 60 percent of its elephants in the past five years, down from 110,000 to fewer than 44,000. During the same period, neighboring Mozambique is reported to have lost 48 percent of its elephants. Locals, including poor villagers and unpaid park rangers, are killing elephants for cash—a risk they're willing to take because even if they're caught, the penalties are often negligible. But in central Africa, as I learned firsthand, something more sinister is driving the killing: Militias and terrorist groups funded in part by ivory are poaching elephants, often outside their home countries, and even hiding inside national parks. They're looting communities, enslaving people, and killing park rangers who get in their way.

South Sudan. The Central African Republic (CAR). The Democratic Republic of the Congo (DRC). Sudan. Chad. Five of the world's least stable nations, as ranked by the Washington, D.C.-based organization the Fund for Peace, are home to people who travel to other countries to kill elephants. Year after year, the path to many of the biggest, most horrific elephant killings traces back to Sudan, which has no elephants left but gives comfort to foreign-born poacher-terrorists and is home to the janjaweed and other Sudanese cross-continental marauders.

Park rangers are often the only forces going up against the killers. Outnumbered and ill equipped, they're manning the front line in a violent battle that affects us all.

GARAMBA'S VICTIMS

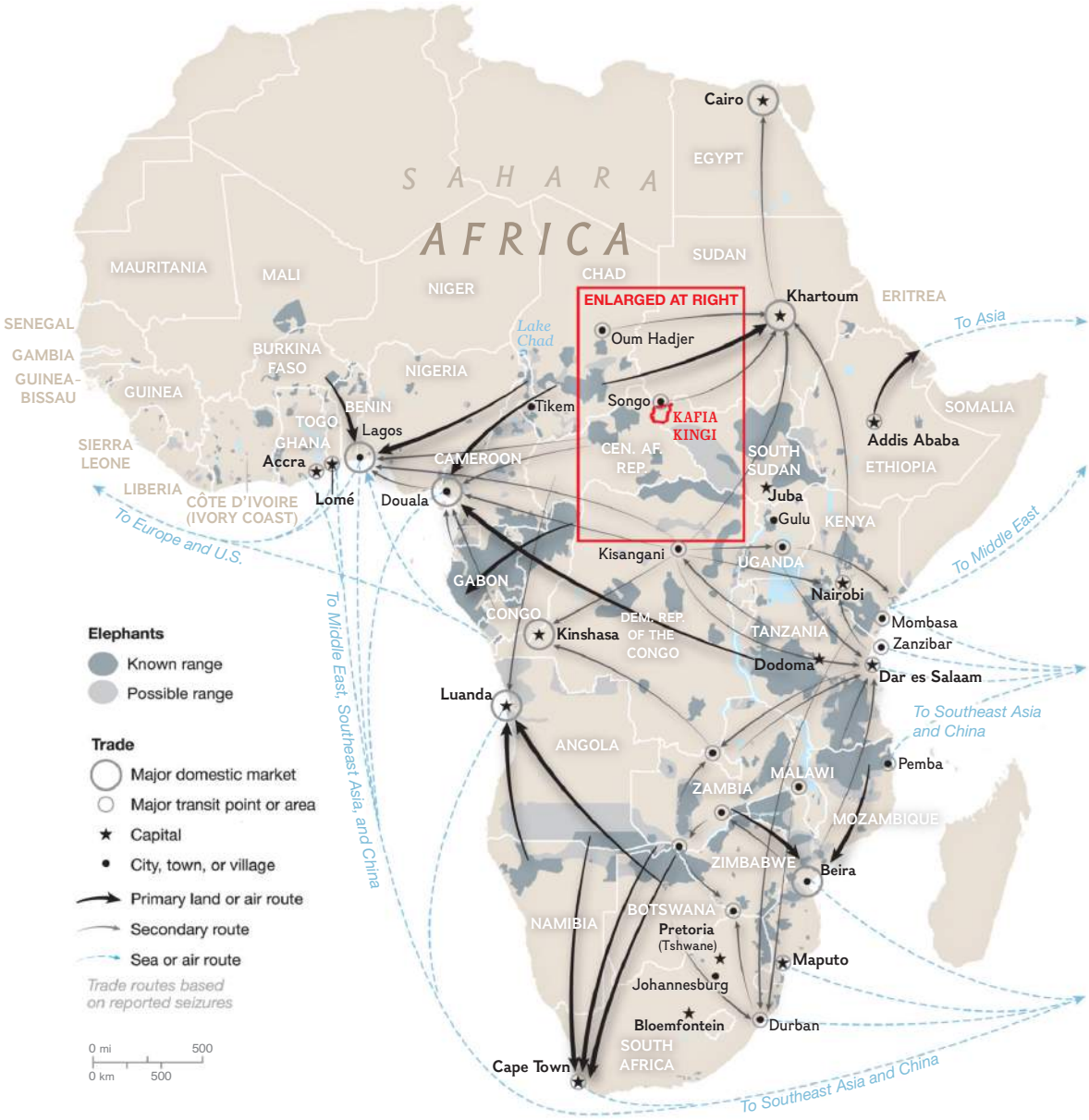
Garamba National Park, in the northeast corner of the DRC and on the border with South Sudan, is a UNESCO World Heritage site, internationally famous for its elephants and its boundless


POLICE

In January 2014, while x-raying a Vietnam-bound container declared to hold cashews, Togolese port authorities saw something strange: ivory. Eventually, more than four tons was found, Africa's largest seizure since the global ivory trade ban took effect in 1990. DNA suggests that some of the ivory is from the elephants killed in CAR in 2013.

TUSK TRADE

During the past decade the trafficking of ivory has turned increasingly professional and militaristic. Organized networks of poachers prey on elephants in regions where instability and violence are rife. Ivory can rise tenfold in price as it moves through African transit points to lucrative retail markets such as China and Southeast Asia.



Making a Killing

Value in U.S. dollars of tusk per pound, based on July 2014 sampling

Smugglers' Trail

Ivory contraband is a rich source of financing for terrorist groups like the Lord's Resistance Army, which has conducted vicious attacks on villages in central Africa. To trace the illicit trade, National Geographic commissioned the creation of artificial tusks with hidden GPS trackers that were planted in the smuggling supply chain.

Killings by armed groups against civilians, December 2008 to June 2015

Lord's Resistance Army killings

Killings by other groups connected to poaching

100 fatalities
10
1

LRA leader Joseph Kony, reported locations, March 2006 to May 2015

Track of artificial tusks

GPS location

Elephants

Known range

ZAKOUMA NATIONAL PARK
Nearly 90 percent of the park's elephants were poached between 2002 and 2012. Improved security in recent years has prevented further killings.

Site of Heban massacre, 2012

ZAKOUMA NATIONAL PARK

CHAD

Groups in Sudan:
Janjaweed
Sudan Armed Forces (SAF)
Abu Tira
Unidentified armed groups

DARFUR

DAY 53
Last known tusk location, as of June 2015
Ed Daein

SUDAN

KAFIA KINGI
Controlled by Sudan, this disputed territory is believed to be a safe haven for the LRA.

BOUNDARY CLAIMED BY SOUTH SUDAN

Songo

DAYS 21 to 44

Dafaq

KAFIA KINGI

RADOM NATIONAL PARK

Kafia Kingi

BOUNDARY CLAIMED BY SUDAN

SATELLITE EVIDENCE
Smugglers held the artificial tusks for three weeks at this camp in Kafia Kingi before moving north.

MANOVO–GOUNDA–SAINT FLORIS N.P.

BAMINGUI-BANGORAN N.P.

DAY 16
Tusks cross into South Sudan

Groups in South Sudan:
Sudanese People's Liberation Army (SPLA)
Sudan Armed Forces (SAF)
Unidentified armed groups

DAY 10

SOUTH SUDAN

Group in Central African Republic:
Seleka

CENTRAL AFRICAN REPUBLIC

DAY 5

SOUTHERN N.P.

GARAMBA NATIONAL PARK
LRA defectors say Kony has ordered poachers into the park with quotas and delivery deadlines.

Obo

Mboki

DAY 1
Tracking of tusks begins

GARAMBA NATIONAL PARK

Kpaika

Nagero

Dungu

DEMOCRATIC REPUBLIC OF THE CONGO

Kony first enters the DRC with 70 fighters on March 8, 2006.

0 mi 100
0 km 100

VIRGINIA W. MASON, HEIDI SCHULTZ, AND BRAD SCRIBER, NGM STAFF

SOURCES: ARMED CONFLICT LOCATION & EVENT DATA PROJECT; C4ADS; BRYAN CHRISTY; CITES ETIS TRAFFIC; DIGITALGLOBE (SATELLITE IMAGERY); IUCN/SSC AFRICAN ELEPHANT SPECIALIST GROUP (RANGE DATA, 2012); THE RESOLVE LRA CRISIS INITIATIVE AND INVISIBLE CHILDREN; UNEP/GRID-ARENDAL; WORLD DATABASE ON PROTECTED AREAS

After Lucienne Lanziwa's husband died in an LRA attack on Garamba, she got a modest stipend. Widows now get a sum equal to six years of a ranger's salary. Ranger Dieudonné Kumboyo Kobango, standing with his son, Genekpio, who escaped soon after the LRA seized him, says, "I search for the LRA on every patrol."

ocean of green. But when I ask a gathering of children and elders in the village of Kpaika, about 30 miles from the park's western border, how many of them have visited Garamba, no one raises a hand. When I ask, "How many of you have been kidnapped by the LRA?"—I understand why.

Father Ernest Sugule, who ministers to the village, tells me that many children in his diocese have seen family members killed by the Lord's Resistance Army, or LRA, the Ugandan rebel group led by Joseph Kony, one of Africa's most wanted terrorists. Sugule is the founder of a group that provides assistance to victims of Kony's army. "I've met more than a thousand children who have been abducted," he says as we talk inside his church in the nearby town of Dungu. "When they're abducted, they're very young, and they're forced to do horrible things. Most of these children are very, very traumatized when they come back home." They have nightmares, Sugule continues. They have flashbacks. Their own families are afraid that they're devils, or forever soldiers, who might kill them in the night. It is assumed that the girls were raped, so it's difficult for them to find husbands. Villagers sometimes taunt returned children with the same expression used for Kony's men: "LRA Tongo Tongo." "LRA Cut Cut"—a reference, Sugule explains, to the militants' vicious use of machetes.

Kony is a former Roman Catholic altar boy whose stated mission is to overthrow the Ugandan government on behalf of the Acholi people of northern Uganda, and to rule the country according to his version of the Ten Commandments. Since the 1980s, and beginning in Uganda, Kony's minions are alleged to have killed tens of thousands of people, slicing the lips, ears, and breasts off women, raping children and women, chopping off the feet of those caught riding bicycles, and kidnapping young boys to create an army of child soldiers who themselves grow into killers.

In 1994 Kony left Uganda and took his

murderous gang on the road. He went first to Sudan, initiating a pattern of border-hopping that continues to make him difficult to track. At the time Sudan's north and south were in a civil war, and Kony offered Sudan's government, in Khartoum, a way to destabilize the south. For ten years Khartoum supplied him with food, medicine, and arms, including automatic rifles, antiaircraft guns, rocket-propelled grenades, and mortars. It was thanks largely to efforts by the group Invisible Children and its video *Kony 2012* that Kony became a household name in the West. In the United States, Presidents George W. Bush and Barack Obama supported efforts either to arrest or kill him. The U.S. State Department named Kony a "specially designated global terrorist" in 2008, and the African Union has designated the LRA a terrorist organization.

When north and south Sudan signed a peace agreement in 2005, Kony lost his Sudanese host. In March 2006 he fled for the DRC and set up camp in Garamba National Park, then home to some 4,000 elephants. From Garamba, Kony signaled his desire for peace with Uganda, sending emissaries to neutral Juba, in southern Sudan, to negotiate with Ugandan officials while he and his men lived unmolested in and around the park, protected by a cease-fire agreement. His army farmed vegetables. Kony even invited foreign press into his camp for interviews. Meanwhile, flouting the cease-fire, his men crossed into CAR, where they kidnapped hundreds of children and made sex slaves of women they brought back to the park.

Father Sugule introduces me to three young girls, recent LRA kidnapping victims, who are sitting on a wooden bench in his church. Geli Oh, 16, spent longer with Kony's army than her two friends—two and a half terrible years. She looks at the floor while her friends whisper to each other, smile radiantly, and nibble on cookies we've brought for them. Geli Oh perks up at

Margaret Acino was 23, pregnant, working in the fields near Gulu, Uganda, when an LRA commander called for a razor and ordered his boy soldiers to slice off her lips, ears, and nose. Seven surgeries later she's forgiven them. "It's easier to live with things," she says.

the word "elephant." She saw many elephants in Garamba National Park, she says, which is where the LRA took her. Tongo Tongo shot two elephants one day, she says. "They say the more elephants they kill, the more ivory they get."

Kony's force has declined from a peak of 2,700 combatants in 1999 to an estimated 150 to 250 core fighters today. Killings of civilians have likewise dropped, from 1,252 in 2009 to 13 in 2014, but abductions are rising again, and it takes the arrival of only a few of the armed militants to send fear ricocheting through communities. In village after village along the road between Father Sugule's church and what is now South Sudan, I meet Kony victims who describe being fed elephant meat and how, after elephants were killed, militants took the ivory away.

Dead elephants finance terrorism. "Ivory operates as a savings account for Kony," says the U.S. State Department's Marty Regan.

But where?

THE PROBLEM SOLVER

To follow my artificial tusks from the jungle to their final destination, I need a tracking device capable of transmitting exact locations without dead zones. It needs to be durable and small enough to fit inside the cavities George Dante would make in the blocks of resin and lead that formed the tusks. Quintin Kermeen, 51, based in Concord, California, has the credentials, and the personality, I'm looking for. Kermeen started in the radio-tracking business when he was 15 and has since built electronic trackers and collars for wildlife from Andean bears to California condors to Tasmanian devils. He designed a GPS tracker that the U.S. Geological Survey embedded in live Burmese pythons to monitor the invasive snakes in the Florida Everglades. For his Judas pig project he built GPS satellite collars to enable pest control authorities in New Zealand to send feral pigs into the bush and locate their invasive piggy friends. We meet over Skype.

"You must be a real animal lover," I say.

"I'm not an animal lover," he snaps. "I'm a problem solver."

I laugh. "Then you're just the man for me."

After months of tinkering, Kermeen's final bespoke ivory-tracking device arrives in the mail. It consists of a battery capable of lasting more than a year, a GPS receiver, an Iridium satellite transceiver, and a temperature sensor.

While Dante set about embedding Kermeen's tracker inside his tusk mold, a third team member, John Flaig, a specialist in near-space, balloon-based photography—images taken from at least the height of spy planes—was preparing to monitor the tusks as they moved. Using Kermeen's technology, he could adjust how many times a day they tried to communicate with a satellite via the Internet. We would follow them using Google Earth.

"I WANT IVORY FOR AMMUNITION"

On September 11, 2014, Michael Onen, a sergeant in Kony's army, walked out of Garamba National Park carrying an AK-47, five magazines of ammunition, and a story. Onen is short and looks even smaller wearing a camouflage-patterned Ugandan army uniform that's too long for him in the sleeves. He sits on a plastic chair opposite me in a clearing at the African Union forces base in Obo, in the southeastern corner of CAR, where he is in custody. Onen had been part of an LRA poaching operation in Garamba consisting of 41 fighters, including Kony's son Salim. The operation was designed by Kony himself, Onen says. During the summer Kony's soldiers had killed 25 elephants in Garamba, and they were on their way back to Kony carrying the ivory.

Around us stroll Ugandan army soldiers, who make up the entire African Union contingent based in Obo and are committed to finding and killing Kony. The soldiers embrace Onen as one of their own, and in fundamental ways he is. He

was 22 years old the night in 1998 that Kony's soldiers raided his village in Gulu, Uganda, and pulled him from his bed. His wife, abducted later, was killed.

From the moment of his capture, Onen says, he was a complainer. Being small, he balked at having to carry the heavy bundles that Kony's militants ferry from camp to camp in their patrols across central Africa, and for his whining, he was beaten with a machete. But Onen got his way. Instead of being made a soldier, he was designated a signaler—a radioman privy to Kony's secret communications.

During the failed peace talks with Uganda, while Kony hid in Garamba from 2006 to 2008, Onen had been assigned to Kony's lead peace negotiator, Vincent Otti. Otti liked elephants, Onen recalled, and forbade their killing. But after Otti left Garamba to participate in the peace talks, Kony began killing elephants for ivory.

Otti was furious, Onen says. "Why are you collecting ivory?" Otti demanded of Kony. "Aren't you interested in peace talks?"

No, I want ivory for ammunition to keep fighting, was Kony's reply, according to Onen, who was listening to transmissions. "Ivory operates as a savings account for Kony," says Marty Regan, of the U.S. State Department's Bureau of Conflict and Stabilization Operations. Kony's army had arrived in Garamba in 2006 with little ammunition left to continue its war, Onen tells me. "It's only the ivory that will make the LRA strong," he recalls Kony saying.

Instead of signing a peace agreement, Kony had his peace negotiator executed.

From Garamba, Kony sent an exploratory team to Darfur to look into forging a new relationship with the Sudan Armed Forces (SAF), who had supported him against Uganda, hoping to exchange ivory for rocket-propelled grenades and other weapons. Meanwhile, according to Onen, Kony's men hid ivory by burying it in the ground or submerging it in rivers. His account was corroborated by Caesar Achellam, a former intelligence chief for Kony who is now in the Ugandan government's custody. Achellam told me that Kony's men planned for the future. He said they bury sealed buckets of water along parched travel routes and bury ivory for safekeeping as well.

"They can get what they want today," he said, "and keep it there for two, three, or even more than five years."

The Ugandan military finally attacked Kony's Garamba camps in late 2008. The air strike, dubbed Operation Lightning Thunder, included support from the DRC, southern Sudan, and the U.S. But it failed to rout Kony or his leadership. Kony's response was immediate and savage. Beginning on Christmas Eve, his soldiers spread out in small teams and murdered civilians. In three weeks Kony's brutes killed more than 800 people and kidnapped more than 160 children. The UN estimated that the massacre displaced more than a hundred thousand Congolese and Sudanese. On January 2, 2009, the horror bled into Garamba's headquarters, at Nagero, where Kony soldiers burned the park rangers' main building, destroyed equipment, and killed at least eight rangers and staff members.

Six years later, on October 25, 2014, Onen tells me, his poaching mission to Garamba was scheduled to deliver its ivory to Kony in Sudan. Kony was adamant in his radio transmissions. "Do not lose even one tusk," he instructed the group, according to Onen, who said the plan was to carry the ivory to a rendezvous in CAR and then on to a market town in Darfur called Songo, not far from the Sudan Armed Forces garrison in Dafaq. There, Onen says, Kony's men trade ivory with the Sudanese military for salt, sugar, and arms. The relationship is close: "SAF warns Kony if there's trouble," Onen says.

As far as Onen knew, the poaching squad he abandoned was still making its way north from Garamba through CAR to Sudan. To me, it seems reasonable to think that the radioman's defection might have slowed the progress of the 25 elephants' tusks headed to Kony.

Maybe I could get my fake tusks to Kony too.

"YOU ARE A LIAR!"

An official in Dar es Salaam's international airport, in Tanzania—one of several countries I

Members of the Ugandan army's dog-tracking team lift weights at the African Union base in Obo, CAR. The dogs are Belgian Malinois shepherds, famed for their use in military operations, especially in tough conditions like the dense central African bush.

scouted for launching my tusks into the illegal trade—squints at an x-ray screen as my luggage rolls through his scanner.

"Open that one," he orders.

I unzip my suitcase to expose two fake tusks and hand him letters from the U.S. Fish and Wildlife Service and *National Geographic* certifying that they're artificial. A crowd gathers. Officials are pointing fingers and arguing. Those looking at the tusks think I'm an ivory trafficker. Those looking at the x-ray screen, which shows the trackers inside, think I'm smuggling a bomb. After more than an hour of animated debate, they phone the airport's wildlife expert. When he shows up, he picks up a tusk and runs his finger over the butt end. "Schreger lines," he says.

All of central Africa is a hand grenade, its pin pulled by a history of resource exploitation from abroad, dictatorships, and poverty.

"Exactly," I say. "I had them ..."

He points a finger at me, and yells, "You are a liar, *bwana!*" (Bwana is Swahili for "sir.")

In ten years he's never made a mistake, he says: The tusks are real. I spend a night in police custody, where I'm given a desk to sleep on. National Geographic television producer J. J. Kelley takes the floor in the waiting area. He asks for water for me and is led out of the building. When he returns hours later, he has three chicken dinners and several bottles of beer, paid for by the police chief. The three of us eat together (the police chief, a Muslim, leaves the beer to us). In the morning, after officials from Tanzania's Wildlife Division and the U.S. Embassy arrive, I'm released.

Our airport incident was one of many hiccups with the artificial tusks. Several Tanzanian officers who had presided over my arrest at the airport, including the wildlife expert, returned the next day to wish us bon voyage. "You did exactly what you were supposed to do," I said, shaking their hands.

It was reassuring to find the Tanzanian law enforcers so vigilant, because the country is plagued by perhaps the worst elephant poaching in Africa, and corruption is rife. In 2013, Khamis Kagasheki, then Tanzania's minister of natural resources and tourism, declared that the illegal ivory trade "involves rich people and politicians who have formed a very sophisticated network," and he accused four members of Tanzania's Parliament of being involved in it.

GARAMBA'S WARRIORS

All around me I hear the click-clack of automatic weapons being loaded. I've flown from Garamba park headquarters to a dirt airstrip deep inside the park to join an antipoaching patrol. I arrive at what amounts to the park rangers' northern front, an outpost vulnerable both to Sudanese poachers and Kony's army. Here a ranger unit is permanently deployed to protect one of the park's most important assets: a radio tower that was being built. Garamba is managed through a partnership between the DRC's wildlife department and African Parks, a group based in Johannesburg, South Africa.

Since the 2008-09 attack by Kony's soldiers, rangers have finished building a new headquarters and acquired two airplanes and a helicopter. But ammunition is in perilously short supply—not even enough for basic training—and the rangers' largest weapon, a belt-fed machine gun, tends to jam every third round or so. The rangers I'm going out with have each been allocated a handful of rounds for old and unreliable AK-47s, most of them seized from poachers.

We plunge eight hours through elephant grass so tall and thick it's possible to get lost just 20 feet from the man in front of you—down grass ravines, up hills exposed to the enemy, across a murky, waist-deep pond. At the sound of a twig cracking or the detection of an unexpected scent on the wind, a ranger in front of me, Agoyo Mbikoyo, signals caution, and I drop with the

team into a collective crouch and wait silently. I make a mental note that Kony's soldiers and other armed groups walk hundreds of miles from Sudan into this endless grass curtain to kill elephants. I wonder if Kony's men are out there now.

The recent death toll of elephants in Garamba has been staggering, even by central African standards. Poachers killed at least 132 last year, and as of this June, rangers had discovered another 42 carcasses with bullet holes, more than 30 attributed to a single Sudanese poaching expedition—a combined loss amounting to more than 10 percent of the park's entire population of elephants, estimated now to be no more than about 1,500.

From March 2014 to March 2015, Garamba's rangers recorded 31 contacts with armed poachers, more than half of whom were with groups traveling south from the direction of South Sudan and Sudan. They included South Sudanese armed forces (SPLA) and Sudanese military, as well as defectors from those militaries and an assortment of Sudan-based rebels. Congo's own soldiers threaten the park's southern border, and villagers around the park sometimes poach elephants too. And someone—it's unclear who—is believed to be killing elephants from helicopters, as evidenced by bullet holes in the tops of skulls and the removal of tusks by what can only be chain saws.

"My interpretation," says Jean Marc Froment, then director of the park, is that the Ugandan military "is conducting operations inside Garamba and at the same time taking some ivory." But, he adds, the poachers could be SPLA, which uses the same type of helicopter seen over the park. An adviser to the Ugandan military rejects the helicopter accusation, and suggests that the elephants might have been shot in the top of the head after they were down.

Having worked extensively throughout central Africa, Froment transferred to Garamba in early 2014 after rangers discovered dozens of elephant carcasses in the park. It was supposed to be a short posting, but he saw too much death to leave. He'd grown up not far from Garamba at a time when it was possible to fly over the park and see 5,000 elephants in a single gathering. Now it was rare to see 250 in a herd.

Froment uses the word "war" to describe the fight Garamba's 150 rangers are in with poachers. Money is available to outfit the rangers with better equipment, but buying new weapons requires formal approval of the Congolese army, something Froment has been unable to get.

Halfway through our patrol, we come upon a clearing of burned grass beside the Kassi River, the site of a recent battle between Garamba rangers and SPLA poachers, in which, rangers tell me, they killed two poachers. I find a human skull fragment, and I nearly pick up a live hand grenade near where the SPLA had camped, mistaking it for a baby tortoise. It hadn't exploded—yet.

All of central Africa is a hand grenade, its pin pulled by a history of resource exploitation from abroad, dictatorships, and poverty. "The poaching issue is a governance issue," Froment says. "We protect the elephant to protect the park. We protect the park to give the people something of value." He fights for elephants because he knows that without the animals' presence, no one will support Garamba, and the park—which he calls "Africa's heart"—will be lost. Garamba is a crucible within a crucible, a park under siege in a country often in civil war in a region that has nearly forgotten peace.

On our patrol we don't encounter any poachers or rebel groups. But time is stalking our team: Months later, on April 25, 2015, while on patrol, the ranger who led me into Garamba, Agoyo Mbikoyo, was shot and killed by a gang of poachers. In June three more Garamba-based officers were killed. The culprits are believed to have been South Sudanese, according to African Parks.

PLANTING THE FAKE TUSKS

After visiting Garamba, I arrange with a confidential source to put my tusks into the black market near Mboki, a small village in CAR midway between Garamba and Sudan that has been the target of attacks by Kony's army and where some people who have escaped from Kony have

found safety. According to data stored in a GPS unit taken off the body of LRA commander Vincent "Binany" Okumu, who was killed in a 2013 firefight with African Union forces on his return from poaching in Garamba, this village is on the path of ivory headed to Kony's base in Darfur.

UNWITTING TARGETS

It was just after 4 a.m. on Heban hill, in Chad, 80 miles from the Sudanese border and 60 miles northeast of Zakouma National Park, home to the country's largest remaining elephant herd, 450 animals. Six antipoaching rangers and their cook, the entirety of the Hippotrague (French for "roan antelope") unit, were awake, dressed in camouflage uniforms, and preparing for morning prayers—devoted even in the darkness. It was the rainy season, and the rangers, like the elephants they were guarding, had left the park for higher ground.

Zakouma breathes its elephants. Dry season in, rainy season out. During the rains the park is more lake than land, and elephants split into two groups to escape the floods. One moves north toward Heban, the other west toward central Chad.

The rangers on Heban hill had little reason to be concerned for their safety. They were relieving a ranger team that had raided a Sudanese poachers' camp three weeks before and seized more than a thousand rounds of ammunition; mobile phones holding photographs of bloated, dead elephants; a satellite phone with a solar panel charger; two elephant tusks; a pair of camouflage pants; and a uniform with the insignia of Abu Tira—Sudan's notorious Central Reserve Police, alleged to have committed mass killings, assaults, and rapes in Darfur. The rangers also recovered a stamped Sudanese army leave slip granting three soldiers permission to travel from Darfur to a town near the Chadian border.

Zakouma National Park has lost nearly 90

Zakouma's Mamba Team 1 antipoaching unit includes driver Issa Adoum (brown shirt). After Sudanese poachers killed his ranger father, Adoum refused *diya,* a traditional community payment. "Diya is for accidents," he says. Poaching has been curbed, but rebuilding the park's herd, now at 450, will take years.

percent of its elephants since 2002. Most—up to 3,000—were poached from 2005 to 2008. During those years Sudanese poachers arrived in groups of more than a dozen armed men, camping inside the park for months at a time, killing, in one instance, 64 elephants in a single hunt. When in 2008 the Wildlife Conservation Society introduced a surveillance airplane, poaching declined, but Sudanese marauders adapted, returning in hit squads of under six men, who infiltrated from outside the park on one-day hunts. They killed fewer elephants per hunt but were much harder to track and stop. Now, says the park's director, Rian Labuschagne, of African Parks, "my biggest fear is that they'll start coming in pairs."

The men of the Hippotrague unit assumed that after the previous team's raid, the poachers had all fled home. But instead, that morning the poachers were hiding among trees surrounding the rangers' camp. The poachers opened fire, killing five rangers. A sixth, a young lookout, ran down the hill, disappeared, and is presumed dead. The team's cook, also wounded, struggled 11 miles to get help. Later, when Labuschagne examined the trajectory of bullets at the scene, he concluded that the poachers had been trained in how to set up a cross fire, which, combined with evidence found at the scene, pointed to President Omar al-Bashir's Sudan Armed Forces.

The story typically would have ended with the wanton killing of these park rangers protecting elephants. But one of the murdered men, Idriss Adoum, had a younger brother, Saleh, who resolved that, when the rains stopped, he and a cousin would hunt the killers in Sudan, where so many ivory roads lead.

SUDAN'S COMPLICITY

As Somalia is to piracy, Sudan has become to elephant poaching. In 2012 as many as a hundred

A welcome sight returns to Zakouma: babies. Thanks to stepped-up enforcement, the park hasn't lost an elephant to poachers since 2012. Without the stress of poaching, the elephants started breeding again, and more than 40 calves have been born.

Five of the six men in Zakouma's Hippotrague patrol unit were killed by elephant poachers outside the park; the sixth is presumed dead. The family of Idriss Adoum (second from left) tracked one suspect to Sudan. The cook, Djimet Said (opposite), was shot but survived, walking 11 miles to the nearest village for help.

Sudanese and Chadian poachers on horseback rode across central Africa into Cameroon's Bouba Ndjidah National Park. They set up camp and in a four-month rampage killed up to 650 elephants. According to Céline Sissler-Bienvenu, Francophone Africa director for the International Fund for Animal Welfare, who led a group into the park after the slaughter, the poachers were most likely from Darfur's Rizeigat tribal group, with ties to the janjaweed—the violent, Sudanese-government-backed militias that have committed atrocities in Darfur. Sudanese and Chadian poachers were likewise implicated in the 2013 butchering of nearly 90 elephants—including 33 pregnant females as well as newborn calves—near Tikem, Chad, not far from Bouba Ndjidah.

That members of the Sudanese military trade arms for ivory with the LRA raises questions about the highest levels of Sudan's government. In 2009 Bashir became the world's first sitting head of state indicted by the International Criminal Court (ICC) in The Hague for war crimes and crimes against humanity. In presenting that case, ICC prosecutor Luis Moreno-Ocampo underscored Bashir's control of the groups said to be behind Sudan's ivory trafficking: "He used the army, he enrolled the Militia/Janjaweed. They all report to him, they all obey him. His control is absolute."

Michael Onen, the defector from Kony's army, told me that the LRA and the janjaweed had battled over ivory, with one group robbing the other, and that it was the janjaweed's success in trading ivory that originally gave Kony the idea to start killing elephants. The LRA sells to the Sudan Armed Forces, Onen said.

Despite Sudan's role as a safe haven for groups known to traffic ivory, such as the LRA, janjaweed, and other poaching gangs, the country has drawn limited official attention as a poaching state. The Convention on International

Trade in Endangered Species of Wild Fauna and Flora (CITES), a treaty organization that governs international trade in ivory—and its continuing ban—has identified eight countries "of primary concern" when it comes to international ivory trafficking: China, Kenya, Malaysia, the Philippines, Thailand, Uganda, Tanzania, and Vietnam. Eight more are considered of secondary concern: Cameroon, Congo, the DRC, Egypt, Ethiopia, Gabon, Mozambique, and Nigeria. Three more are classified as of "importance to watch": Angola, Cambodia, and Laos.

The artificial tusks follow a route LRA defectors tell me ivory takes to Kony's Kafia Kingi base. By now the tusks may be in Khartoum.

Sudan is not on these lists, even though Sudanese poachers are a primary reason elephants are killed in several of the countries listed by CITES as of primary or secondary concern. Sudan is also a well-documented supplier of ivory to Egypt and is the recipient of substantial Chinese infrastructure investment, which typically comes with Chinese workers, a source of ivory smuggling in many parts of Africa. Ivory shops in Khartoum advertise in English and Chinese as well as Arabic. According to CITES Secretary-General John Scanlon, Sudan does not appear on these lists because CITES sets priorities based mainly on ivory seizures, and there have been few ivory seizures linked to Sudan in recent years. Which raises the question: If ivory is poached by Sudanese, where is it going?

A KONY HIDEOUT

My artificial tusks sit motionless for several weeks, a pair of tear-shaped blue dots on my computer screen, which displays a digital map of the eastern corner of CAR. Then, like a bobber in a fishing hole, a nibble. They shift a few miles. Suddenly they move steadily north, about 12 miles a day along the border with South Sudan, avoiding all roads. On the 15th day after they began to move, they cross into South Sudan and from there make their way into the Kafia Kingi enclave, a disputed territory in Darfur controlled by Sudan.

Kafia Kingi is so widely recognized as a Kony hideout that in April 2013 a coalition of groups, including Invisible Children, the Enough Project, and the Resolve, issued a report called "Hidden in Plain Sight: Sudan's Harboring of the LRA in the Kafia Kingi Enclave, 2009-2013." LRA defectors I spoke with consistently placed the warlord in the Kafia Kingi area too. So did the African Union military forces, whose CAR-based men in Obo are tasked with finding Kony. "It's not a secret to anyone that Kony's in Sudan," says the State Department's Marty Regan. "It's his sanctuary."

A few days later the tusks proceed to Songo, the Sudanese market town where Onen said Kony's men trade ivory. In Songo the tusks are held for three days in what looks like a clearing outside town. Then they head south six miles, back into Kafia Kingi. I order a satellite shot of their location from DigitalGlobe, a commercial vendor of space imagery, and ask for outside help interpreting it. According to Col. Mike Kabango, of the African Union forces, the image shows a large tent and two smaller ones; to Ryan Stage, a remote-sensing specialist in Colorado, it shows a large truck and two small tents. After three weeks the tusks turn north again, back into Sudan. Gathering speed, they continue north before abruptly turning east, in the direction of Khartoum.

Other roads also lead to Sudan. The relatives of murdered Zakouma ranger Idriss Adoum tracked one of the alleged Heban hill poachers to Sudan and arranged to have him brought back to Chad to stand trial. Soumaine Abdoulaye Issa had been in Darfur, he told a team of African Parks investigators, when he heard about an elephant poaching mission to Chad led by a member

of the Sudan Armed Forces. Issa, who is Chadian, said he joined the team of three Sudanese men and that together they rode more than two weeks to get to Heban, where they killed nine elephants in four days. After Zakouma's rangers destroyed their camp and confiscated their equipment, the poachers were unable to return to Sudan, so three weeks later they went back to Heban hill and attacked the Hippotrague unit.

Issa claimed he was merely a lookout, not a poacher. He wasn't contrite. In a public square in Am Timan, shortly before his trial, he shouted, "I know who betrayed me! I will escape from your jail, and I will kill him." He did escape, and a rumor in Zakouma is that he fled south to CAR.

"We've heard he went to Seleka," Idriss Adoum's son Issa tells me, referring to the violent rebel coalition that overthrew the CAR government on March 24, 2013. If true, Soumaine Issa will find poachers working with Seleka. Seleka and its rival, anti-Balaka, have set fire to people, thrown them off bridges, and murdered people wantonly, turning CAR into a lawless state—the kind of place where Kony's group and other terrorist organizations thrive. In May 2013 Seleka-backed Sudanese poachers attacked Dzanga Bai, an elephant oasis in Dzanga-Ndoki National Park of southwest CAR, killing 26 elephants. Dzanga Bai—also known as the village of elephants—is a mineral-rich mudhole where the animals congregate.

Earlier this year Kony suffered the defection of his commander of operations, Dominic Ongwen, who told African Union forces that Kony's desire for ivory was reinforced by Seleka. "Seleka rebels had a stock of about 300 ivory tusks that they sold, which enabled them to get the supplies that helped them overthrow President François Bozizé in CAR," Ongwen told African Union forces, according to his debriefing. Ongwen said Kony's plan is to obtain as much ivory as possible "for his future survival should he not be able to overthrow the government of Uganda."

Ongwen also said that Kony intends to form a squad to establish contact with Boko Haram, the Nigerian terrorist group responsible for widespread killings and the kidnappings of hundreds of Nigerian women and schoolgirls. Boko Haram also uses the bush as a base—Nigeria's Sambisa Forest, a game reserve south of Lake Chad. In March 2015 Boko Haram's leader, Abubakar Shekau, pledged allegiance to ISIS, and his group was renamed Islamic State's West Africa Province, giving that Middle East terrorist group a foothold in West Africa.

WHERE NEXT?

As of this writing, my artificial tusks sent out their last communication from a Sudanese town called Ed Daein, 500 miles southwest of Khartoum. I know which house they're in: Using Google Earth, I see its light-blue roof on my screen. They're in a place 2.2 degrees Fahrenheit cooler than the ambient temperature, so perhaps they've been buried in the backyard. So far they've traveled 600 miles from jungle to desert in just under two months. Their path is consistent with the route Kony's defectors tell me ivory takes on the way to the warlord's Kafia Kingi base. By the time you read this, my tusks might have gone to Khartoum. Or possibly even shown up in illegal ivory's biggest consuming country: China.

Meanwhile, as leaders in Europe, the Middle East, and the U.S. strategize about how to stop the ever expanding network of international terrorist organizations, somewhere in Africa a park ranger stands his post, holding an AK-47 and a handful of bullets, manning the front line for all of us. ☐

"This assignment was exciting for me because it wasn't just another animal exploitation story," says writer **Bryan Christy,** who reports on wildlife trafficking frequently for this magazine. "It was the story of an unspoken war."

BYBA SEPITKOVA

Brent Stirton has won numerous awards for his investigative photojournalism. His subjects for this story weren't shy, he says. "They've been through a lot, and they were comfortable having their lives revealed."

POINT OF NO RETURN

How a forgotten peak rising from the jungles of Myanmar nearly broke an elite team of mountaineers

A bone-freezing wind whips the climbing rope as Cory Richards moves up an exposed ridgeline during an attempt to summit Hkakabo Razi, said to be Southeast Asia's tallest mountain.

RENAN OZTURK

Mark Jenkins (standing) and Renan Ozturk pause for lunch within sight of the snowcapped peak of Hkakabo Razi (top left). The climbers hoped to be the first to measure the mountain's height precisely using a GPS.

A bridge offers passage over the Tamai River en route to the mountain's base. The climbers spent weeks pushing through dense rain forest, avoiding snakes and staving off claustrophobia along the dark, tunnel-like trails.

By Mark Jenkins
Photographs by Cory Richards

The wind slams into me, and I desperately grip my ice axes to keep from being ripped off the mountain face. I push my head against the snow, calm myself, and look down. Beneath my crampons is a 5,000-foot drop. It's like looking down from the open door of an airplane. I am roped to my two companions, with nothing attaching us to the mountain. A fall here would send all three of us plummeting to our death.

When the wind subsides, I pound an aluminum stake into the snow and clip the rope to it. It wouldn't hold if I were to fall but gives me enough psychological comfort to continue. I concentrate, methodically swinging my ice tools and kicking my crampons. At a rock rampart I place an anchor and belay my partners, Cory Richards and Renan Ozturk, across the chasm.

"Nice lead, dude!" Cory shouts above the roar of the wind when he arrives. He climbs onward, slanting left, searching for a passage up through the granite and snow. When Renan reaches me, there is no room on my ledge, so he traverses out to his own perch. Cory carefully tiptoes the teeth of his crampons along a thin ledge above us and disappears from sight.

Renan and I wait, hunched against the wind. We stomp our feet and painfully slap our gloved hands. We are too far apart to talk. We just stand there, together but alone, on the side of the snow-plastered cliff more than three miles in the sky. After a half hour we begin to freeze. After an hour we can no longer feel our fingers or toes. "I can't take it anymore," Renan yells through his frozen beard. "My feet are gone. I have to start moving."

We don't know what Cory is doing above us, but we're so cold it doesn't matter. Renan starts climbing, then I follow. We're all still roped together, so it's crucial that none of us fall. The rope is supposed to be secured to the mountain to catch a fall, but mortal predicaments like this happen often in mountaineering. When there are no good anchors, your partners become your anchors, physically and emotionally. You must trust your life to their judgment and ability, and they entrust their lives to yours. This is the code of the mountains.

Renan and I halt in a small rock recess overlooking the north face of the mountain. Through blowing spindrift we can see Cory traversing another expanse of snow. It is too dangerous for Renan and me to keep moving. Again, we must wait. We huddle close, but we're still freezing. The wind swirls around our bodies, howling and biting at us like invisible hyenas. "My feet are turnaround cold," Renan says. What he means is that they're close to frostbite.

I wonder, for at least the tenth time on this expedition, whether this is the end of our quest to climb the highest peak in Myanmar—a journey that has pushed us to our physical and emotional limits. Far below us on the mountain, our other team members are pulling for us in spirit. Our base camp manager, Taylor Rees, is at the foot of the mountain. The previous day we left Hilaree O'Neill and Emily Harrington at camp 3, a tent nested on a snowy ridgeline, where our weary team had a bitter argument over who would try for the summit.

Stretched to the limit, the team—which included (left to right) videographer Renan Ozturk, author Mark Jenkins, photographer Cory Richards, climber Emily Harrington, and expedition leader Hilaree O'Neill—began running low on food on the hike out. "None of us anticipated we'd get that strung out," says Cory.

I tell Renan to take off his boots and place his feet underneath my down parka, against my chest. He has socks on, and my chest isn't exactly a furnace, but it's the best we can do.

When Cory makes his way around a rock buttress, we start moving. An hour passes before we finally regroup on a thin ledge. Our immediate goal remains far above us—the crest of the west ridge, glistening like the edge of a sword.

"My lead," Renan says. He begins climbing, woodenly kicking his crampons into the snow. He disappears into the sun. The rope tightens, and Cory takes off. After he vanishes, I follow.

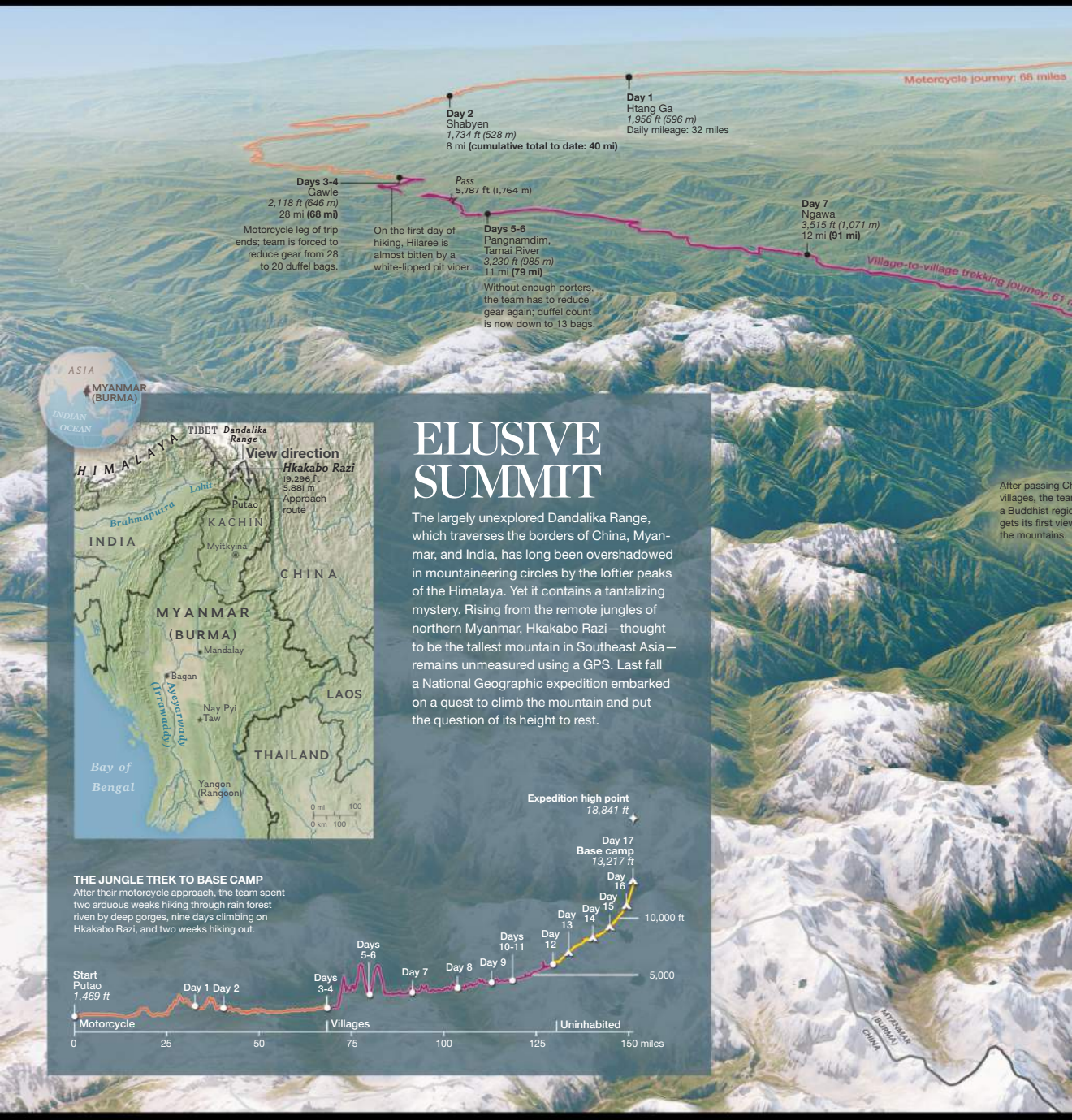
When I reach the ridge and push my ice-crusted face into the sun, it's like poking my head into heaven. The sudden warmth renews my hope. I pull my body onto the ridge, and a blanket of sunlight envelops me. After the dark, soul-sucking cold of the north face, it feels like rebirth.

Renan and Cory have dropped over the ridge to get out of the wind and discovered a stone platform hanging above the south face. The sun is spread over the rock like honey. "Lunch ledge!" I bellow, christening our aerie.

Within minutes I've got our tiny stove roaring. Renan takes off his boots and begins rubbing his toes. Cory gets out his camera and begins snapping pictures. After more than a week of climbing, this is the first time we can actually see the summit: a steep, shining pyramid of snow. But we can also see what we have left to climb: a menacing, serrated ridge of rock and snow, guarded by a dozen dagger-like pinnacles.

"LET'S DO AN old-school adventure," Hilaree had said, "an expedition to someplace still remote and unknown." It was the spring of 2012, and we were coming off Mount Everest. Hilaree is the

TAYLOR REES

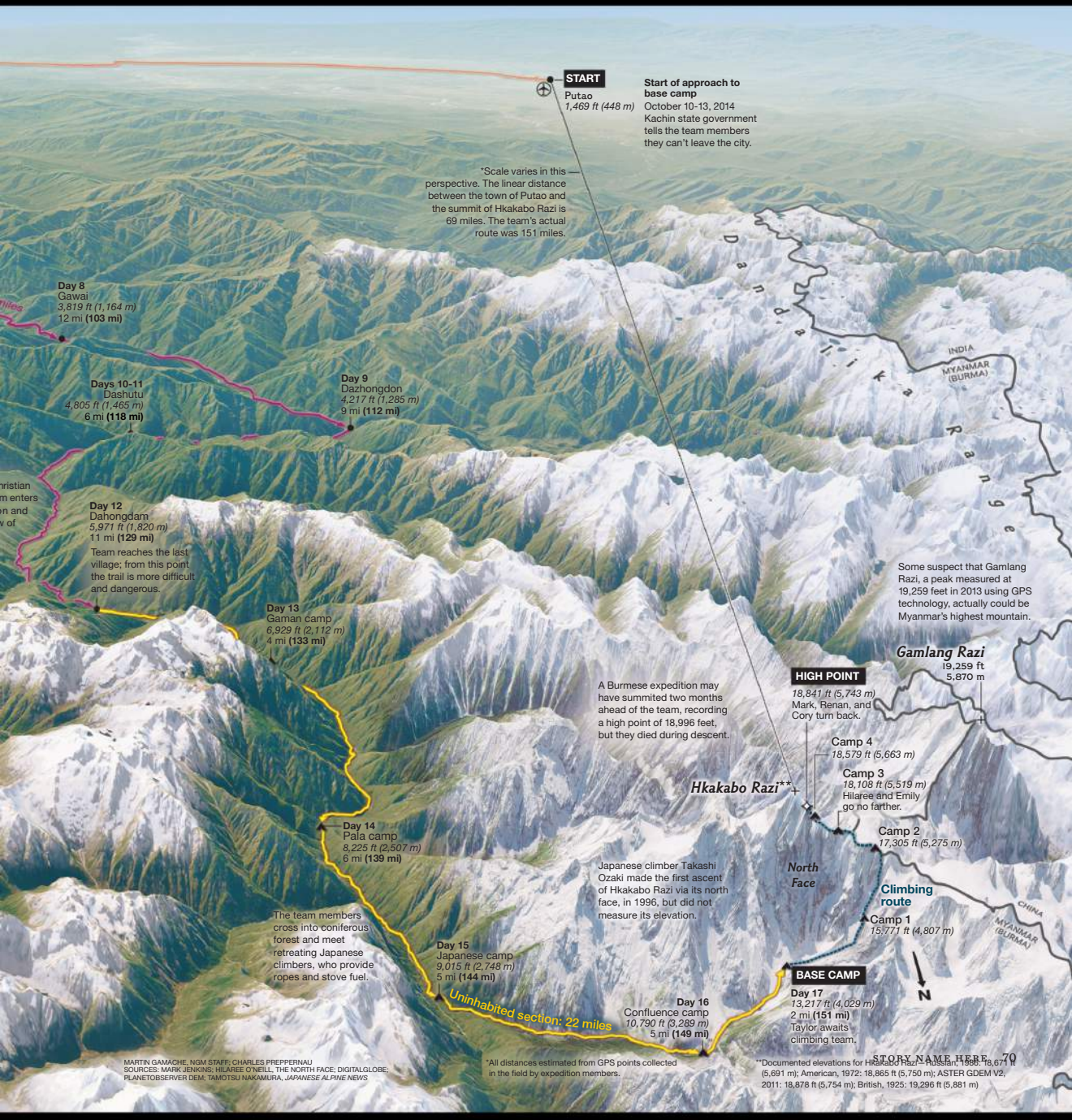


ELUSIVE SUMMIT

The largely unexplored Dandalika Range, which traverses the borders of China, Myanmar, and India, has long been overshadowed in mountaineering circles by the loftier peaks of the Himalaya. Yet it contains a tantalizing mystery. Rising from the remote jungles of northern Myanmar, Hkakabo Razi—thought to be the tallest mountain in Southeast Asia—remains unmeasured using a GPS. Last fall a National Geographic expedition embarked on a quest to climb the mountain and put the question of its height to rest.

THE JUNGLE TREK TO BASE CAMP

After their motorcycle approach, the team spent two arduous weeks hiking through rain forest riven by deep gorges, nine days climbing on Hkakabo Razi, and two weeks hiking out.



MARTIN GAMACHE, NGM STAFF; CHARLES PREPPERNAU
SOURCES: MARK JENKINS; HILAREE O'NEILL, THE NORTH FACE; DIGITALGLOBE; PLANETOBSERVER DEM: TAMOTSU NAKAMURA, *JAPANESE ALPINE NEWS*

*All distances estimated from GPS points collected in the field by expedition members.

**Documented elevations for Hkakabo Razi: Russian, 1988: 18,671 ft (5,691 m); American, 1972: 18,865 ft (5,750 m); ASTER GDEM V2, 2011: 18,878 ft (5,754 m); British, 1925: 19,296 ft (5,881 m)

The team's route passed by religious sites such as the Mingun Pagoda, near Mandalay, in central Myanmar. Construction began in 1791. The facade was later split by an earthquake.

Balancing a 60-pound load, a porter tightropes a hanging bridge. The team struggled to find locals to haul gear. "We had about 35, we wanted about 60," says team member Taylor Rees. Eventually, they had to leave equipment behind.

toughest woman I've ever met. After summiting Everest, she climbed its neighbor, Lhotse, with two torn ligaments in her ankle.

We had a lot in common. Both of us had grown up loving mountains. We were both married with two kids and trying to find a way to balance family life with expeditions. And we were both disillusioned by Everest's commercialism and crowds. We needed to get back to what made us climbers to begin with.

But finding someplace truly remote is tricky. A plane will take you to the North or South Pole, you can hop a helicopter to the base camp of Everest or Makalu, tourist boats cruise the Nile and the Amazon. Real remoteness—somewhere that requires days or even weeks of walking just to reach—has almost vanished from Earth.

And yet I knew a place, a mountain that had long held me in its thrall. But because of my private history with it, I was reluctant to say anything. Eventually, after bouncing ideas back and forth—Pakistan, Papua New Guinea, Kazakhstan—my enthusiasm got the best of me. "What about," I hesitated, "Hkakabo Razi?"

Hkakabo Razi (pronounced KA-kuh-bo RAH-zee) is said to be the highest peak in Southeast

Porters take a break on a bed of bamboo leaves. In some villages, the team hired entire families, even grandparents, to carry gear. Most were Rawang people who live in remote valleys near the Tibetan border and rarely encounter outsiders.

The Rawang were not immune to the vagaries of the jungle. A toddler was brought to us with infected insect bites. A tribal elder told me, "Everyone here either gets better on their own or dies."

Asia. It is a jagged massif of black rock and white glaciers that rises improbably out of the steaming green jungles of northern Myanmar. Located just beyond the eastern edge of the Himalaya, on the border with Tibet, it was first measured by a British survey published in 1925 at 19,296 feet high. It is a peak so remote, few climbers have heard of it even today. Getting to the mountain would require a two-week trek through dense jungle riven with plunging gorges and inhabited by venomous snakes. Hilaree was hooked immediately. We were planning our expedition before we left Kathmandu.

I had learned of Hkakabo in the 1980s, when I picked up a yellowed copy of *Burma's Icy Mountains* by British explorer Francis Kingdon-Ward. It described his 1937 expedition into the region and his audacious attempt to climb Hkakabo Razi solo. He reached almost 16,000 feet before being stymied by an insurmountable "granite wall... beyond my powers."

Kingdon-Ward's "powers," as I learned from reading his many other books, were protean. A brilliant botanist, lyrical writer, indefatigable

plant hunter, and purportedly a British spy, Kingdon-Ward was one of those hard-as-iron adventurers in the mold of polar voyager Roald Amundsen or Amazonian explorer Percy Fawcett. Kingdon-Ward could tramp through jungle for months on rice and tea, writing in his journal at night beside a campfire. From 1909 to 1956, he made more than 20 expeditions into Central Asia, during which he survived a fall off a cliff and one of the century's worst earthquakes. Along the way he collected hundreds of plants and named many, including species of rhododendrons and lilies that now adorn gardens worldwide.

I was entranced by Kingdon-Ward's journeys and was determined to make the first ascent of Hkakabo Razi. So in the fall of 1993, I enlisted my climbing buddies Steve Babits, Mike Moe, and Keith Spencer. We called ourselves the Wyoming Alpine Club. Mike had been my best friend since high school in Laramie, and I'd met Keith and Steve at the University of Wyoming. Since then, Mike and I had done several first ascents in the Rockies and the first kayak descent of the Niger River in West Africa.

At that time the military junta controlling Burma—later renamed Myanmar—had declared the north off-limits to foreigners. We naively planned to avoid this obstacle by accessing the mountain from Tibet, illegally crossing the border, traveling light and fast with no porters.

We flew to Lhasa with our rucksacks and proceeded to sneak across eastern Tibet—also closed to foreigners—hitching rides in the backs of trucks and talking our way past checkpoints. It took more than a month just to get near the base of the mountain. Mike and Steve had to return home, leaving only Keith and me to climb. We ran out of food on the north side of Hkakabo

Stepping cautiously, porters follow a narrow trail cut into the side of a ravine. “One slip and you were a goner,” says Mark, who had previously attempted Hkakabo in 1993. “There are so many ways to die before you can even see the mountain.”

and had to descend to a Tibetan village. There we were promptly arrested by the Chinese military, interrogated, and jailed. We signed a four-page confession of "misconduct" and were deported.

Two years later, to my chagrin, the Myanmar government granted Japanese mountaineer Takashi Ozaki permission to climb Hkakabo Razi. Ozaki was an unstoppable Himalayan veteran, having made the first full ascent of the north face of Everest in 1980. (He would die climbing there in 2011.) He made two failed attempts on Hkakabo in 1995, but in September 1996, after two months of climbing, Ozaki summited with Tibetan-born mountaineer Nyima Gyaltsen. He told the *Asia Times,* "I can say absolutely that Hkakabo Razi is one of the most difficult and dangerous mountains in the world. I was never scared before, like this time."

Ozaki published a detailed account of his expedition, but he did not measure the summit elevation with a GPS, which left the mountain's exact height undetermined.

Young and convinced of our invincibility, Mike, Keith, and I talked about returning to Hkakabo. (Steve had moved on to different adventures.) But it was not to be. Mike died on an expedition in 1995, along with his brother and two others. A bowhead whale tipped over their boat in the Arctic Ocean, and they all perished from hypothermia. Mike left behind a wife and three kids. None of us ever quite recovered.

Near base camp, Renan, Emily, and Hilaree found Buddhist prayer flags. Following a Himalayan mountaineering tradition, they burned juniper boughs for good luck. Weeks before, two Burmese climbers had disappeared on Hkakabo Razi.

The past weeks spent with Cory and Renan have been like looking back in time at myself and my two dead friends. In these two younger men I see the same passion for climbing, the same sense of being bulletproof we had 22 years ago.

Still, Keith and I continued doing expeditions and often ice climbed together. On January 2, 2009, we were on the fifth pitch of an icefall in north Wyoming. I was belaying him from a small alcove in the ice. He was cheerfully climbing 15 feet below me when we heard a deafening roar. A section of ice above us had cut loose. Seconds later tons of ice crashed down. Keith was killed, his neck broken by the impact.

There was no reason why I lived and Keith died. We'd taken the safety precautions. He didn't do anything wrong, and I didn't do anything to save myself. There was no moral, aside from the inescapable truth that mountains are dangerous, and occasionally inflict horror and sorrow on those who dare to climb them.

LOUNGING ON OUR LUNCH LEDGE in the sun on Hkakabo Razi, slurping down hot noodles

with Cory and Renan, I am reminded of my lost friends. Mike was funny like Cory, who's kept us going through some of the trip's worst moments with perfectly timed wisecracks. Keith was quiet like Renan, always taking in the grandeur around him, always the calm voice in the midst of crisis. During these past weeks I've spent with Cory and Renan, it's been a bit like looking back in time at myself and my dead friends. I recognize in these two younger men the same passion for climbing mountains, the same determined toughness, the same boundless ambition, and at moments the same sense of being bulletproof that Mike, Keith, and I had 22 years ago.

Our resolve replenished, we begin to study the crenellated ridge before us that leads to the summit. Because the mountain has remained largely unexplored, we are climbing with little knowledge of the terrain. Even satellite images don't reveal the true difficulty of the climb. From the lunch ledge, the route ahead looks more demanding than what we've encountered so far.

Hkakabo's west ridge is a two-mile-long saw blade—a series of stone towers separated by sharp cols of snow. Unlike on some mountains, where you can shoot right up to the summit, we have been climbing up and down the jagged ridgeline the whole way—up a tooth of rock, rappelling down the backside, balancing across a bridge of snow, then up the next craggy pinnacle. We try to identify a potential route, but the spiked ridge weaves like a serpent's tail so we can't see all the obstacles. We do, however, spot a notch that looks like the best location to bivouac for the night. We pack up and start moving, trying to stay on the sunny side of the ridge.

It takes us four hours to reach the notch. We

Renan descends a slope after finding the route impassable. Negotiating the region's maze of unmapped ridges and false summits forced the team to backtrack twice, squandering precious time and energy.

A snow-swollen couloir threatens to envelop Hilaree (at left) and Emily (below) as they ascend its powdery flank. The risk from avalanches and rockfalls increased as the team moved higher up the steep, fog-shrouded terrain.

Leeches would drop down onto our necks as we pushed through wet branches or suck onto our legs during stream crossings. All day we'd pluck their blood-engorged bodies off our skin, leaving bites that didn't fully heal for weeks.

are so fatigued that we can barely stomp out a tent platform. Our faces are rimed with ice from breathing so hard. While trying to shove the poles into our tent, the wind lifts it like a kite. We throw in our packs, guy it down, and pile inside.

"The shiver bivvy begins," says Cory as he zips the tent, closing off the screeching blackness that has descended on the mountain.

We knew this night was going to be misery. At camp 3 we could see that the ridge became technical and treacherous. So we ruthlessly cut the weight of our packs, bringing only bare essentials, hoping it would be enough to get us to the top and back down. We left our winter sleeping bags and carried only the thin overbag shells. We have one stove, one fuel bottle, one pot, one spoon, two instant pasta meals, and the three of us are crammed into a two-person tent.

Sitting knee-to-knee, our backs pressed against the tent, we set our stove on our boots and nearly asphyxiate ourselves boiling water from snow. One person holds the stove, another the pot. We are wearing everything we have. Only our headlamps and runny noses stick out from beneath the hoods of our parkas. Renan says little, which is normal. But even Cory is quiet.

We have been sleeping with each other for weeks, like poor brothers in one bed. We know each other's secrets. I know Renan is dealing with the betrayal of a friend. I know Cory's struggling to stay married and be a world-traveling photographer. They know I'm haunted by memories of my dead friends, that this mountain is my white whale. My thoughts drift to how close we are to our goal and our team's ugly fight and the toll it's taken on my friendship with Hilaree.

JUST GETTING TO THE FOOT of Hkakabo Razi took a month. The very thing that Hilaree and I had wished for on the slopes of Everest—remoteness—was the very thing that threatened our expedition from the beginning.

First we had to cross most of Myanmar. From Yangon we took an overnight bus to Bagan, then a ferry up the Irrawaddy River to Mandalay, where we got on a train that bucked and swayed as if it would derail at any moment. In Myitkyina we boarded a plane where a fellow passenger checked an AK-47 as carry-on luggage. On arrival in Putao, the northernmost town in Kachin state, we spent five days "under arrest" while our climbing permits were batted back and forth among officials. Finally, we loaded our gear onto a caravan of motorcycles and set off for three days, crashing through streams and churning through mud until the trail became passable only on foot.

Then began the 151-mile trek to the base of Hkakabo through the wet, dark jungle. The dense forest canopy cast a dim green glow. For two weeks we moved along this tunnel-like track, always rising steeply or plunging suddenly, from one local enclave to the next, exactly as Francis Kingdon-Ward had done 77 years earlier.

We slept in the bamboo homes built on stilts of the Rawang people. Although Kachin state is known for its jade and gold mines and for illegal logging, people this far north mainly raise pigs and chickens and grow little plots of rice.

On the first day trekking in the jungle Hilaree was almost struck by a snake. She saw it coiled on the trail at the last moment and leaped over it. Poised to strike, the serpent's flat head floated side to side, its black tongue squirting in and out. We all kept our distance except Cory, who knelt down and began snapping photos. "White-lipped pit viper," he declared.

It was one of a dozen snakes toxinologist

Zoltan Takacs had warned us about before we came to Myanmar. If one of us were bitten, the venom could cause bleeding from the nose, eyes, gums, and rectum and could be fatal. We carried two antivenoms, one for vipers, the other for cobras and kraits, but Takacs had warned us that relying on antivenom in the jungle was dicey.

Far less dangerous were the leeches. They would drop down onto our necks as we pushed through wet branches or suck onto our feet and legs during stream crossings. All day we'd pluck their blood-engorged bodies off our skin, leaving bites that didn't fully heal for weeks.

And then there were the spiders. We continually pushed through cobwebs the size of fishing nets. Some held spiders baring fangs so large they were visible from a few feet away.

The Rawang were not immune to the vagaries of the jungle. In one village a distraught mother brought a screaming child to us, her tiny body swollen from infected bites. Hilaree and Emily smeared antibiotic cream on her arms, legs, and face. When I asked what would become of the child, a tribal elder told me, "Everyone here either gets better on their own or dies."

The legs of one of our youngest porters, a schoolgirl of about 12, were so welted with bites that her skin was as bumpy as a toad's. She was one of three girls of similar age whom we shamefully hired, along with their brothers, parents, and grandparents, to carry our gear. We hired anyone we could find. They all hefted loads with practiced efficiency. We'd recruit porters from one village to help us get to the next village up the trail. Some would work for a few days, others just for a few hours. Sometimes they'd abandon us without a word, slipping away in the night.

The truth is, we had brought far too much stuff—cameras and lighting equipment, laptops, extra batteries, even two drones to get aerial footage—the paraphernalia of a modern expedition. But it was all useless without enough strong backs to carry it. So we began leaving bags of gear in the villages we passed through until we were down to a quarter of our initial load.

At almost any other time, we would have encountered plenty of locals along this trail willing to make $15 a day, twice the local wage. But when we arrived in the fall of 2014, Hkakabo Razi had improbably become front-page news.

On September 10, 2014, three weeks before our team left the United States, an Associated Press headline read: "Search for missing climbers begins in Myanmar." An eight-man, all-Burmese expedition had set out for Hkakabo to put one of its citizens atop the country's highest peak. It was a matter of national pride. On August 31, after two weeks of climbing, two team members signaled from somewhere near the summit. They were never heard from again.

An enormous search effort was mounted. Porters were recruited from local villages to supply the search teams. Choppers buzzed over the jungle between Putao and the mountain. Then one of the helicopters, with two pilots and a passenger, disappeared. The search for the climbers was suspended, and a search for the helicopter ensued. Nine days later, the helicopter's passenger stumbled out of the jungle and led rescuers to the pilots: One was alive but severely burned, the other dead.

After decades of quiet obscurity, Hkakabo Razi had claimed three lives in one month.

Another American climbing team was partly behind this sudden Burmese attention to the mountain. The year before, Andy Tyson, a Teton-based guide, had led an American-Burmese expedition to a neighboring peak called Gamlang Razi. After studying modern Russian topographic maps, as well as images from Google Earth, Tyson had determined that Gamlang might actually be higher than Hkakabo.

Tyson's team made the first ascent of Gamlang Razi in September 2013. Using a survey-grade GPS, they measured its height at 19,259 feet. Although this was still 37 feet lower than Hkakabo's 1925 British survey height of 19,296, it was higher than the 18,671 feet that Russian surveyors had calculated in the 1970s and 1980s.

"No one in Burma wanted to believe that Gamlang was higher than Hkakabo," Tyson told me last year, noting that Hkakabo is a long-revered symbol of national pride, and a foreigner

calling its prominence into question embarrassed some Burmese. (Tragically, Andy Tyson was killed in a plane crash in April.)

In fact the Burmese expedition had set out to prove that Hkakabo Razi was still the country's highest peak. Before disappearing on the upper reaches of the mountain, their ill-fated climbers had transmitted a GPS reading of 18,996 feet.

In my own research, I had contacted Robert Crippen, an Earth scientist for NASA. We discussed the various methods for measuring Gamlang and Hkakabo. "The real bottom line is that errors of 30 meters [100 feet] or more might not be evident, and this is about the difference in these peaks," he said. "So we have evidence, but no proof, for which one is higher."

The highest mountain in Myanmar would remain a mystery until someone stood on the summit of Hkakabo with a GPS.

RENAN, CORY, AND I PASS THE SPOON, each of us gulping down hot soup, while the wind punches at the tent like a boxer working a heavy bag. When the pot has cooled, we hand it around and swill the last of the liquid. We pack snow inside the pot, put it back on the stove, and keep melting snow until each of us has a full hot water bottle, which we will sleep with on our chests. It is so cold we would prefer to just stay locked together around the purring stove all night—screw the toxic fumes—but we don't have enough fuel. We turn off the stove knowing that the next hours will feel like several days.

We arrange our ropes and packs underneath ourselves and try to find some way we can all stretch out. If we lie on our sides, it's just possible.

"Nothing I like more than spooning with two really smelly dudes," Cory quips.

We are so smashed together that none of us

Blocked by tooth-like rock spires, Mark turns back from the ridge leading to Hkakabo's snowy summit. To go on, the team would've had to spend a night without food, a tent, or sleeping bags. "We'd have lost digits, if not our lives," says Cory.

have been trying to hold it in for a couple of hours. My back has been against the tent wall for so long the cold has penetrated through to my chest. "I need to start the stove or something."

"Get in the middle, I'll take the outside," says Cory. We trade places, and I don't get warm, but I don't get any colder. We stay in this position for as long as we can stand it. In the darkest, coldest hour, I start imagining someone finding our bony bodies lined up in the snow like crooked logs. Finally, finally, daybreak comes.

BACK IN THE JUNGLE, two days before reaching base camp, we met a bone-weary, hollow-eyed Japanese team that was retreating from Hkakabo as if returning from the front lines of an epic battle. We'd heard about them and had been concerned that they'd summit ahead of us, rendering all our efforts meaningless before we even got to see the mountain. But they'd been delayed by the rescue of the Burmese climbers. Eventually, they had made their own attempt via the west ridge, which was also the route we intended to take.

Their team leader, Hiro Kuraoka, was injured. He had slipped among the boulders and badly

If one of us were to slip off the ridge, the only way to save his life would be for the next climber on the rope to quickly jump off the opposite side, both men praying in the millisecond that the rope wouldn't sever.

can move without elbowing or kneeing each other. We don't expect to sleep. We expect to suffer. We pull our balaclavas down over our faces like knights closing their visors in preparation for battle. We put our mittens beneath our hips to insulate them against the snow.

Renan and I are on the outside, up against the frost-covered tent walls, while skinny Cory is in the middle. It's like being buried together inside a small tomb. We lie there for hours, each of us floating in our own dark thoughts.

"I'm freezing," I say in the black of night. I

bruised his buttocks. Despite lying in a sleeping bag with a bulging hematoma on his backside, Hiro was animated and generous, explaining their route in detail and showing us numerous photos of the topography from various camps. He said they had been stopped several hundred feet from the summit by a razor's edge of snow and sharp, insurmountable pinnacles.

Like two military platoons passing in the night, we exchanged supplies. We gave Hiro a bottle of ibuprofen, and he gave us stove fuel and ropes. His team was defeated but alive,

Exhausted and disappointed, Cory (left) and Mark sit by the fire in Pangnamdim, one of the last villages on the trek out of the jungle. “We wanted an old-school adventure, and we got one,” says Mark. As for success? “The mountain always decides.”

RENAN OZTURK

All serious mountaineers have big egos. You cannot take on the risks and constant suffering of big mountains without one. We may talk like Buddhists, but don't be fooled, we're actually hard-driving narcissists.

which in the end is all that really matters.

After nearly two weeks of trekking, we finally climbed out of the fetid jungle onto the rising southern flank of Hkakabo. The tropical humidity gave way to a bracing alpine mist, and we dug into our bags for fleeces and down jackets. We'd all lost weight and were tired from the arduous trek. And we were running out of time. In planning the expedition, we had agreed to be home by Thanksgiving. In Kingdon-Ward's time, the end point of an expedition was rarely based on a preset date, but in our modern age, time is the least available commodity. We had just 10 days before we had to begin our hike out. I knew Ozaki had needed 25 days from base camp to climb the mountain.

Over the next week, we put in three camps up the spine of the west ridge, but under time pressure and faced with the difficulty of the terrain, relations among the team were fraying. I was especially concerned when Hilaree reached camp 2 dangerously hypothermic. We got her warm, but it was a cautionary moment. The next day, climbing to camp 3, neither Emily nor Hilaree appeared comfortable on the steep, exposed faces of ice and snow and moved slowly.

In retrospect we should have expected this slower pace. Emily is a national sport-climbing champion but had little experience climbing this kind of mixed terrain. Hilaree is a renowned ski mountaineer with some challenging alpine climbing expeditions on her résumé. But Cory, Renan, and I have deeper backgrounds in this type of environment. Cory had been the first American to summit Pakistan's 26,362-foot Gasherbrum II in winter—and survived an avalanche in the process. Renan had been part of the team that summited India's 20,702-foot Meru Central via the Shark's Fin, a brutal climb many thought impossible. And over 35 years of climbing, I'd done first ascents in Antarctica and the Rockies, Alps, and Himalaya. These experiences didn't change any of the inherent dangers, but it did mean we three were able to move faster and implicitly trust each other with our lives as we tried for the summit.

That night, at camp 3, Renan and Cory both privately expressed concerns about climbing any farther with the entire team. We spent the next day in our tents acclimatizing, and there was no way around the painful conversation. In his soft-spoken way, Renan noted that the climbing was going to get more dangerous. It was also pointed out that three people moving fast had the best chance of summiting in the brief time we had left. Emily readily agreed that she was in over her head. But Hilaree was deeply offended and insisted that she should go for the summit. I explained it was an issue of safety for the whole team, but Hilaree was wounded. "I'm going to say one thing," she said, her voice welling with emotion as she left the tent, "[Expletive] you, Mark, for the vote of confidence."

Nothing is more damning in the mountains than hubris, yet hubris is fundamental to climbing mountains. All serious mountaineers possess big egos. You cannot take on the risks and constant suffering of big mountains without one. We may talk like Buddhists, but don't be fooled, we're actually narcissists—driven, single-minded, masochistic narcissists. Nearly all of us, on some mountain at some time, have defied logic and refused to turn around, as Hilaree was doing now. Some of us have been lucky enough to survive those misguided moments. This may sound harsh, but I'm at a season in my climbing

career where openness and honesty trump polite silence, even with my friends.

We were all weary, light-headed from the thin air, and fearful of what lay ahead, and the conversations over the next hours devolved into shouting, accusations, and recriminations. Eventually, Cory couldn't stand the rancor and said Hilaree could take his place on the summit team. Renan and I were concerned but reluctantly agreed to the new plan.

At three the next morning, as we began to rope up, with a freezing Tibetan wind howling, Hilaree made the correct decision. She said it was too cold for her, reasoning that if she had a second bout with hypothermia, she might endanger the team. She told Cory to go instead.

"WHY DO WE DO THIS?" Cory asks, struggling like a contortionist to put his boots on inside the tiny tent. "Really! Why?" His hands are too numb to tie the laces. "Because it's so much fun," Renan says drily, pressing his elbows against the snapping tent walls.

After 39 days of boats and trains, snakes and leeches; after clawing up the sheer faces of Hkakabo's west ridge; today is summit day. We each take slugs of steaming tea until the pot's empty, then reluctantly crawl out of the tent into the battering wind. Spindrift is whirling around us. The sun is a distant cold ball. We click on our crampons, rope up, and start climbing. Our feet and fingers are numb, but moving beats trembling in the tent. Our blood starts pumping, and warmth gradually returns to our cores.

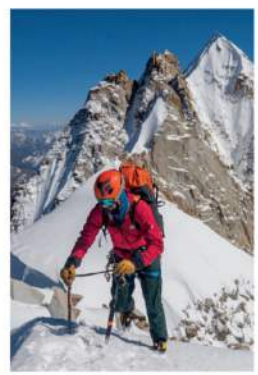
Together we traverse the first of a series of large rock spires. To either side, a mile below us, is an ocean of clouds. If one of us were to slip off the lance-like ridge, the only way to save his life would be for the next climber on the rope to quickly throw himself off the opposite side, both men praying in the millisecond of potential oblivion that the rope isn't pulled taut over a knife-sharp rock and severed. This is the depth of trust required in mountain climbing. This is how you transcend yourself and bond with your climbing partners. It is the reason we climb.

We gather on a little point of snow to reassess. "I'm scared," Cory says. "I'm really [expletive] scared. I think we should turn around."

His naked honesty is strangely comforting. He's saying what we all feel. But Renan and I aren't ready to turn back. I lead down around a snowcapped block, up through a narrow hallway between two slabs of rock, hook along a crescent of snow, and suddenly the entire route to the summit appears before me. I am aghast.

We knew we had one more deep notch in the ridge to negotiate, but I see now that it is filled with massive stone teeth, like the jawbone of a dinosaur. It would take us hours, well into the night, to climb through this wind-gnashed maw. To summit would require another night on the mountain, but this time without a tent, stove, food, or water. We would be perched on a ledge on the side of the mountain in the wind in the dark, and we would freeze to death. It is the point of no return.

I realize we will not reach the top. We will not measure the height of Hkakabo Razi. We will not solve the mystery of Myanmar's tallest mountain. I have been carrying a photo of Mike Moe and Keith Spencer for the entire expedition. In it, Mike and Keith are standing on a mountain wearing puffy down coats, helmets, and wide grins. I so fiercely wanted to place this picture on the summit. But it is not to be. I paw out a little hole and place the photo in the snow. I take a GPS reading at our high point, 18,841 feet, then climb slowly back along the ridge to Renan and Cory. They already know our expedition is over. All we want now is to get down alive. □



See a five-minute excerpt from ***Down to Nothing***, an award-winning film shot by expedition member Renan Ozturk and produced by Camp 4 Collective, available in the magazine's digital editions and at **ngm.com/more.** This expedition was sponsored by a grant from National Geographic's Expeditions Council and The North Face.

True Colors

Chameleons communicate with color change, hunt with lightning-fast tongues—and live in some of Earth's most threatened habitats.

"Where light is, chameleons change," wrote Percy Bysshe Shelley. The poet had the science right: Light-reflecting crystals in skin cells give these panther chameleons their varied colors.

The better a juvenile panther chameleon can blend in with its surroundings, the safer it is from predators. The species is native to Madagascar and continental Africa.

Male panther chameleons face off, displaying intimidating colors. If one doesn't back down, the confrontation may escalate to hissing, ramming, and biting.

By Patricia Edmonds
Photographs by Christian Ziegler

For sheer breadth of freakish anatomical features, the chameleon has few rivals. A tongue far longer than its body, shooting out to snatch insects in a fraction of a second. Telescopic-vision eyes that swivel independently in domed turrets. Feet with toes fused into mitten-like pincers. Horns sprouting from brow and snout. Knobbly nasal ornaments. A skin flap circling the neck like a lace ruff on an Elizabethan noble.

Of all its corporeal quirks, the chameleon is most defined by one, noted as far back as Aristotle: color-changing skin. It's a popular myth that chameleons take on the color of what they touch. Though some color changes do help them blend into their surroundings, the skin's changing hue is in fact a physiological reaction that's mostly for communication. It's the lizard using colorful language, expressing itself about things that affect it: courtship, competition, environmental stress.

At least that's the belief today. "Even though chameleons have attracted attention for centuries, there's still a lot of mystery surrounding them," says Christopher Anderson, a biology postdoctoral associate at Brown University and a chameleon expert. "We're still piecing together how their mechanisms actually work," from the explosive projection of the tongue to the physics of the varying skin colors.

Scientists recently have made important discoveries about chameleon physiology by watching the lizards in captivity. Their future in the wild, meanwhile, is far from certain.

When the International Union for Conservation of Nature (IUCN) released a new Red List assessment of chameleons last November, it ranked at least half the species as threatened or near threatened. Anderson is a member of the IUCN Chameleon Specialist Group, as is biologist Krystal Tolley, a National Geographic grantee whose expeditions in southern Africa have documented new chameleon species and vanishing habitats.

In Afrikaans, says Tolley, chameleons have two common names. One is *verkleurmannetjies,* which means "colorful little men." The other, *trapsuutjies,* translates as "treading carefully." That refers to the lizards' odd, slow gait—but also could be read as a plea to conserve the curious species and their home terrain.

ABOUT 40 PERCENT of the 200-plus known chameleon species are found on the island of Madagascar. Most of the rest live on the African continent. Thanks to DNA testing, some chameleons that look nearly identical have been found to be genetically distinct. More than 20 percent of the known species have been identified in just the past 15 years.

Given their many odd traits, chameleons "have always intrigued naturalists," Anderson

Madagascar's chameleons can be as tiny as *Brookesia micra,* its body less than an inch long, and as large as a two-foot-long Oustalet's chameleon, seen here by baobab trees.

says. Because the lizards often died on the journey from Madagascar and the African continent to Western laboratories, early herpetologists could only guess at how live chameleons worked. That yielded theories that seem laughable now, he says: "It was once thought that the chameleon tongue projected because it inflated with air or filled with blood, like erectile tissue."

Anderson studies chameleon feeding in intricate detail. Using a camera that captures 3,000 frames a second, he turned 0.56 seconds of a chameleon eating a cricket into a 28-second instructional video on projection mechanics.

Stored in the lizard's throat pouch is a tongue bone surrounded by sheaths of elastic, collagenous tissue inside a tubular accelerator muscle. When the chameleon spies an insect, it protrudes its tongue from its mouth, and the muscle contracts, squeezing the sheaths, which shoot out as if spring-loaded. The tongue tip is shaped so that it acts like a wet suction cup, grabbing the prey. The tongue recoils; dinner is served.

Scientists have more to learn about tongue projection, Anderson says. His research suggests that in some chameleons, it may go even farther and faster than previously thought.

The understanding of chameleon coloration

An insect succumbs to a foraging *Calumma* chameleon, whose extremely sharp vision allows it to project its long tongue with pinpoint accuracy.

also has changed over time—and dramatically earlier this year, when Michel Milinkovitch's research was published. Scientists had long thought that chameleons changed color when skin cell pigments spread out along veinlike cell extensions. Milinkovitch, an evolutionary geneticist and biophysicist, says that theory didn't wash, because there are many green chameleons but no green pigments in their skin cells.

So Milinkovitch and his University of Geneva colleagues began "doing physics and biology together," he says. Beneath a layer of pigmentary skin cells, they found another layer of skin cells containing nanoscale crystals arranged in a triangular lattice.

By exposing samples of chameleon skin to pressure and chemicals, the researchers discovered that these crystals can be "tuned" to alter the spacing between them. That in turn affects the color of light that the lattice of crystals reflects. As the distance between the crystals increases, the reflected colors shift from blue to green to yellow to orange to red—a kaleidoscopic display that's common among some panther chameleons as they progress from relaxed to agitated or amorous.

AT AGE SEVEN, Nick Henn got his first chameleon. Twenty years later the hobbyist and breeder keeps as many as 200 of them in the basement of his business in Reading, Pennsylvania.

Rows of wire-mesh cages contain plants for climbing and sandy floors where females can lay eggs. Lights and misters simulate the lizards' native climes. Arranging the cages is as tricky as seating warring factions at a United Nations summit. To keep the animals from riling each other, Henn places females where they can't see males, and males where they can't see females—or rival males.

Ember, a young male panther chameleon, is a so-called red bar, a variety that's native to the Ambilobe district in northern Madagascar. His torso has red and green zebra stripes plus an aqua blue racing stripe along each side. When Henn opens Ember's cage and prods him to climb onto a long stick, he "gets grumpy," which Henn knows because the chameleon's red bars get a little brighter.

Henn carries Ember on the stick around a corner to the cage inhabited by Bolt, an adult male blue-bar panther chameleon and the largest lizard in Henn's collection. When Henn opens the door, and Bolt sees Ember, the response is immediate. By the time Bolt has advanced a few inches, his green bands have turned vivid yellow, and his eye sockets, throat, and spiked spine have changed from green to red orange. Ember becomes redder—but as shows go, Bolt's is far more flamboyant. For good measure, as Bolt crawls nearer, his mouth gapes wide, displaying bright yellow gums.

Henn retreats and puts Ember back in his cage. Had he not, he says, Bolt might have tried to ram or bite Ember, whose skin almost certainly would have changed to brown—the color of crying uncle. (A 2014 study concluded that chameleons developed this fade-to-drab submissive ability because their "slow-moving lifestyle severely restricts their ability to rapidly and safely flee from dominant individuals.")

Though all chameleons change color, some species don't change dramatically enough to cow observers. However, almost all chameleons do have another technique for physical intimidation: They can make themselves look larger. They narrow the width and increase the height of their bodies by unfolding their jointed, V-shaped ribs to elevate their spine. They also can look more massive by coiling their tails tightly and using their tongue apparatus to expand their throats. Turning this profile to its nemesis, the lizard looks significantly bulkier.

In the cages where Henn keeps female chameleons, one named Katy Perry—salmon pink because she's ready to mate—is next door to one named Peanut, pink with dark bars because she has already mated and is gravid, carrying eggs. If Katy were approached by a male that impressed her with his courtship colors and bobbing, swaying dance, she might submit to being mounted. If the same male approached Peanut, she would become intensely darker with bright spots and open her maw menacingly at him. If

Color Coding

Chameleons can quickly change their appearance in response to temperature, environment, and mood. Scientists recently identified a key factor in their ability to do this: The lizards can "tune" the distances between nanoscale crystals in their skin that reflect light, creating a spectrum of colors.

Color changes take 30 seconds to two minutes.

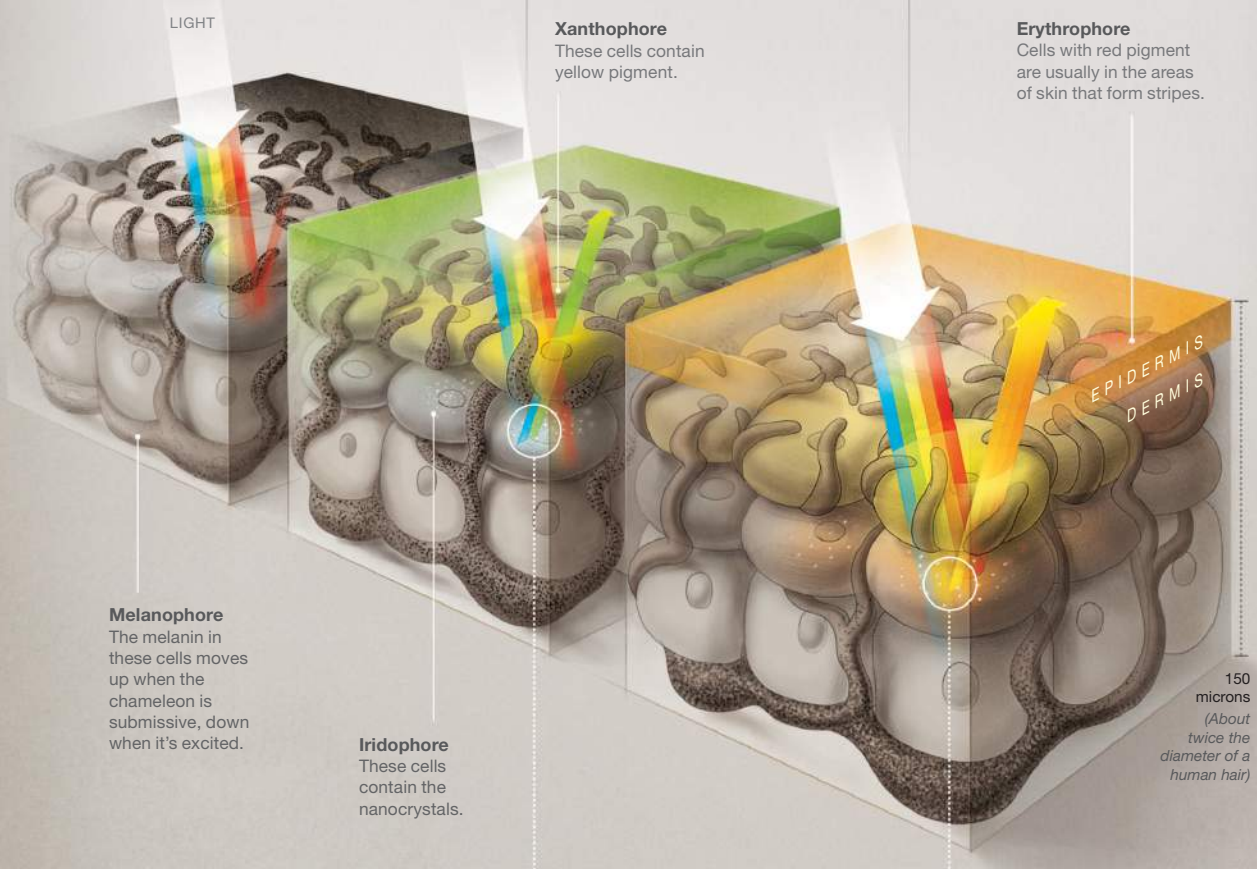
Panther chameleon
Furcifer pardalis

Under Its Skin

SUBMISSIVE
A chameleon turns darker when it needs to demonstrate that it's not a threat—such as after losing a fight—by dispersing melanin, a dark pigment, into its upper skin layers.

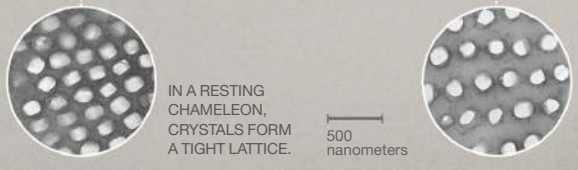
NEUTRAL
At rest, it's typically green or brown to match its environment. Blue and green wavelengths reflect off tightly packed crystals; red and yellow pass through.

EXCITED
Vibrant colors can signal aggression or a desire to mate. Crystals move wider apart, reflecting yellow, orange, and red wavelengths.



Crystal Power

The transparent nanocrystals, made of the DNA building block guanine, form a lattice. Their thickness, spacing, and refractive index determine what color is created.



MANUEL CANALES, NGM STAFF; MEG ROOSEVELT. ART: SHIZUKA AOKI
SOURCES: DEVI STUART-FOX; RUSSEL LIGON; KRISTOPHER KARSTEN; MICHEL C. MILINKOVITCH, JEREMIE TEYSSIER, SUZANNE V. SAENKO, DIRK VAN DER MAREL (INSET PHOTOS)

After these male panther chameleons fought over a female, the victor still sports fighting colors, while the loser has taken on a submissive dark hue.

Madagascar is home to more than 40 percent of all chameleon species. Clockwise from top right: An O'Shaughnessy's chameleon sleeps clinging to a branch. Rostral protuberances—which help individuals of like species identify each other and can be used as jousting weapons—adorn the snouts of a long-nosed chameleon, a Will's chameleon, and a Parson's chameleon, one of the largest species.

he persisted, she'd hiss or try to bite him.

Both male and female chameleons are polygamous. Most species are egg layers, but some deliver live young in clear, cocoon-like sacs. Chameleons do no parenting, so the young are on their own as soon as they're born or hatched.

To avoid the birds and snakes that hunt them, chameleons have evolved novel ways to hide. Most species are arboreal; when they narrow their bodies, they're slender enough to hide on the opposite side of a branch. If ground dwelling chameleons see a predator, Tolley says, some "play leaf," contorting their bodies to look like crumpled leaves on the forest floor.

Chameleons can hide from some threats but not from the slash-and-burn agriculture destroying their habitats. The IUCN lists nine species as critically endangered, 37 as endangered, 20 as vulnerable, and 35 as near threatened.

TOLLEY AND HER TEAM have identified 11 new chameleon species since 2006, in South Africa, Mozambique, Tanzania, and the Democratic Republic of the Congo. The Massachusetts-born professor has studied the lizards in Africa since 2001 and works for the South African National Biodiversity Institute in Cape Town.

When a genetics study confirms that a chameleon is a new species, "it feels like you're not just writing some random scientific paper that nobody will read," Tolley says. "You're accomplishing something—this is going to be forever."

In the next breath she notes that "at the same time as thinking, 'Wow, this is so cool,' it was awful. I keep envisioning the little chameleons clinging to their branches as that forest is getting chopped."

Describing it, her voice breaks. "I could not help thinking, I wish we'd never found them," she says. "Because if this doesn't stop, they'll soon be extinct." □

The entire life cycle of the Labord's chameleon lasts roughly a year. Some chameleon species may live a dozen years in captivity, but less than half that in the wild.

REBECCA HALE, NGM STAFF

Panama-based **Christian Ziegler** trained in tropical ecology before becoming a photojournalist. His natural history, conservation, and science images have won World Press Photo awards and other honors.

Did your subjects for this assignment ever surprise you?
Every day, with their amazing hunting behavior and strange beauty. But my biggest surprise was a sad one, to realize how tiny their remaining habitats are. Chameleons, along with other creatures on Madagascar, really need our help.

Rescuing Mes Aynak

Under threat of Taliban attack, archaeologists are excavating a spectacular Buddhist complex before it's obliterated by a huge copper-mining operation.

The play of perspective makes an eight-foot-tall stone shrine at Mes Aynak, Afghanistan, appear much larger than it is. Archaeologists have uncovered only a fraction of the sprawling Buddhist complex, which dates from the third to the eighth centuries A.D.

BODHISATTVA, SCHIST, 15.3 INCHES, 3RD-5TH CENTURY

11.4-INCH FRAGMENT OF 7-FOOT-TALL BUDDHA, CLAY, 5TH-6TH C.*

DIPANKARA, AN EARLIER BUDDHA, SCHIST, 3RD-5TH C.

WARRIOR (ORIGINALLY ON A HORSE), CLAY, 4TH-5TH C.*

FEMALE PATRON, PAINTED CLAY, 32 INCHES, 5TH-7TH C.

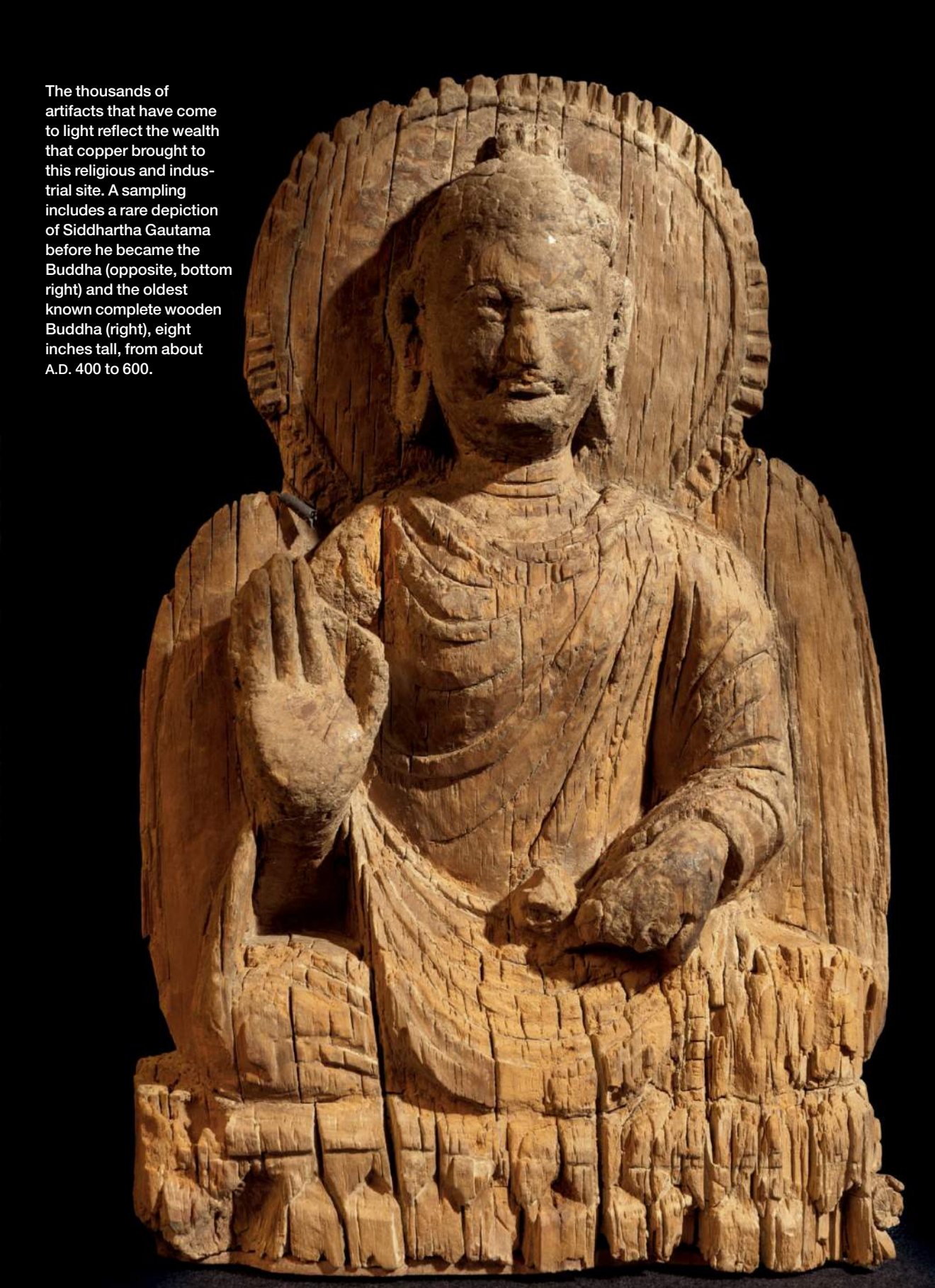
HORSE, CLAY, 3.3 INCHES LONG, 3RD-7TH C.*

BUDDHAS IN TWO TIERS, SCHIST, 9.8 INCHES, 3RD-4TH C.

COIN ISSUED IN NAME OF HUN KING KHINGILA, SILVER, 5TH C.*

SEATED SIDDHARTHA GAUTAMA, SCHIST, 11.2 INCHES, 3RD-5TH C.

The thousands of artifacts that have come to light reflect the wealth that copper brought to this religious and industrial site. A sampling includes a rare depiction of Siddhartha Gautama before he became the Buddha (opposite, bottom right) and the oldest known complete wooden Buddha (right), eight inches tall, from about A.D. 400 to 600.



MOST ARTIFACTS PHOTOGRAPHED AT NATIONAL MUSEUM OF AFGHANISTAN, KABUL; THOSE WITH ASTERISKS PHOTOGRAPHED AT MES AYNAK, COURTESY AFGHAN INSTITUTE OF ARCHAEOLOGY

By Hannah Bloch
Photographs by Simon Norfolk

About an hour's drive along the Gardez highway south of Kabul, beyond the bustling shops, the trucks spewing diesel exhaust, and the clatter of donkey carts, there is a sharp left turn onto an unpaved road. In a district of Logar Province friendly to the Taliban, the vicinity has been shaken by roadside bombs, intermittent rocket attacks, kidnappings, and murders. The road continues along a dry riverbed, past small villages, paramilitary roadblocks, sentry towers, and an empty, blue-roofed compound cordoned off with concertina wire.

A little farther on, the view opens onto a treeless valley creased with trenches and exposed ancient walls. Over the past seven years a team of Afghan and international archaeologists, supported by up to 650 laborers, has uncovered thousands of Buddhist statues, manuscripts, coins, and holy monuments. Entire monasteries and fortifications have come to light, dating back as far as the third century A.D. More than a hundred check posts surround the site, which is patrolled day and night by some 1,700 police.

The excavation is by far the most ambitious in Afghanistan's history. But the security wasn't put in place just to protect a few scientists and some local workers. Buried below the ancient ruins is a lode of copper ore that extends two and a half miles across and runs a mile or more into the Baba Wali mountain, which dominates the site. It ranks as one of the world's largest untapped deposits, containing an estimated 12.5 million tons of copper. In antiquity, copper made the Buddhist monks here wealthy; colossal deposits of purple, blue, and green slag, the solidified residue from their smelting, spill down the slopes of Baba Wali, attesting to production on a nearly industrial scale. The Afghan government hopes that copper will help make the country wealthy again, or at least self-sufficient.

THE NAME OF THIS PLACE is understated: Mes Aynak, "little copper well." There is nothing little about Mes Aynak. In 2007 the Beijing-based China Metallurgical Group Corporation (MCC), leading a state-backed consortium, won rights to extract the copper here on a 30-year lease. (China is ravenous for copper: It now consumes half the world's supply.) The company made a bid worth more than three billion dollars and promised to provide infrastructure for this isolated, underdeveloped district, including roads, a railway, and a 400-megawatt electricity plant. Afghan officials estimated that the mine would provide a $1.2 billion infusion into the country's fragile economy, dependent since 2002

Stained by copper in the soil, a skeleton lies next to a stupa at Mes Aynak. Whether the individual lived when the monasteries were functioning or in a later era is unknown.

on foreign assistance and now facing a seven-billion-dollar annual deficit.

Mes Aynak's archaeological potential has been known for decades. When the Chinese deal became public, Afghan cultural heritage advocates demanded that the place's ancient treasures be excavated and recorded properly before they were lost to an open-pit mine. But the artifacts were already in danger: not from destruction by the Taliban, but from being plucked out piecemeal by looters, lost to science. "If it will not be destroyed by mining, it will be destroyed by looting," says French archaeologist Philippe Marquis, who directed excavations at the site from 2009 to 2014. Better, he says, to document as much as possible now in a systematic way.

Despite the heavy security, present-day dangers have delayed the mine's development. The blue-roofed compound, built for Chinese engineers, was abandoned after a series of rocket attacks in 2012 and 2013. Land mines left behind by the Soviets in the 1980s and explosive devices left more recently by the Taliban and al Qaeda pose yet another danger, and eight

When this photo was taken in 2012, some 500 local laborers were employed at the site, hurrying to rescue its treasures before mining was due to begin. With mining delayed, a smaller crew works today in an area where insurgent influence is growing.

mine-clearing specialists were killed by the Taliban in 2014. (When Afghanistan was under Taliban control, Mes Aynak was the site of an elite al Qaeda camp where four of the hijackers who took part in the 2001 attacks on New York City and Washington, D.C., underwent training, according to the 9/11 Commission.)

Add to the security challenges the logistical complications—the lack of a railway to transport the copper out of the region and a serious scarcity of water—and it's no surprise that mining, originally projected to start in 2012, has not yet commenced. In 2013 the MCC began to back off from some terms of its contract, and the two sides have yet to renegotiate the agreement. It's unlikely that any extraction will take place before 2018, if then.

Delays in the copper mining have given archaeologists considerably more time to excavate. The past they're revealing presents a stark contrast to the violence and disorder of their own time.

The delays have given archaeologists considerably more time to excavate than they had expected, though with a greatly reduced workforce. The past they're revealing presents a stark contrast to the violence and disorder of their own time. From the third to the eighth centuries A.D., Mes Aynak was a spiritual hub that flourished in relative peace. At least seven multistory Buddhist monastery complexes, containing chapels, monks' quarters, and other rooms, form an arc around the site, each protected by ancient watchtowers and high walls. Within these fortified complexes and residences the archaeologists have uncovered nearly a hundred schist and clay stupas, Buddhist reliquaries that were central to worship. The stupas range in size from monumental to easily portable.

Mes Aynak was also a key economic center in Gandhara, a region spanning what's now eastern Afghanistan and northwestern Pakistan. Gandhara was a civilizational crossroads, a place where the great religions of Hinduism, Buddhism, and Zoroastrianism met and where ancient Greek, Persian, Central Asian, and Indian cultures melded. It was the "center of the world," in the words of Abdul Qadir Temory, the lead Afghan archaeologist on the project.

In the first centuries A.D. the Gandharan Buddhists revolutionized the region's art, refining an aesthetic sensibility that had synthesized the vestiges of earlier centuries of conquest. They were among the first artists in the world to depict the Buddha in realistic, human form—a Hellenistic innovation from the days of Alexander the Great, who first marched through Afghanistan in 330 B.C. At Mes Aynak chapels have been uncovered with double-life-size Buddha statues still bearing traces of their red, blue, yellow, and orange painted robes; caches of gold jewelry; fragments of ancient manuscripts; and walls adorned with frescoes. One niche yielded a schist statue featuring a rare depiction of Siddhartha Gautama before he became the Buddha.

Cascades of copper coins from the third to seventh centuries A.D. have also spilled from the site, collected from the floors of dwellings and from where they had been carefully cached by the hundreds. Many bear the image of the second-century Kushan ruler Kanishka the Great. He may or may not have practiced Buddhism—but he welcomed it and other religious traditions in his empire, notably fire-worshipping Zoroastrianism, which originated in ancient Persia. Many of the coins found at Mes Aynak depict Kanishka on one side and either a seated Buddha or a Persian deity, such as Ardokhsha, a goddess of fortune, on the other.

"Kanishka's coinage was valued from Rome to China," says longtime Kabul resident Nancy Hatch Dupree, 87, the U.S.-born grande dame of Afghan heritage scholars. "There are 23 gods and goddesses on Kushan coinage. This symbolizes tolerance. This was a time when people were broadening their thinking."

Though much is known about ancient Buddhism's links to trade and commerce, little is known about its relationship to industrial production. This is where Mes Aynak may be able

Aerial shots taken in 2010 of a mound called Shah Tepe revealed looters' pits (left). Within a year archaeologists had uncovered a grand fortified building (right).

to fill in important blanks, hinting at a more complex Buddhist economic system than has been previously understood. Unlike the far better known Bamian—an ancient Buddhist pilgrimage site and Silk Road caravan center 125 miles to the northwest, formerly home to two colossal, sixth-century Buddha statues carved out of a cliff face, blasted to rubble by the Taliban in 2001—Mes Aynak seems to have thrived primarily because it was a copper extraction and production hub, a Pittsburgh to Bamian's New York. The sacred monastic complexes are right on top of the copper ore.

"I do not know of any other site where monasteries coexisted in perfect [symbiosis] with production or industrial centers," says Zemaryalai Tarzi, an Afghan archaeologist who first visited Mes Aynak with a French team in 1973. "These kinds of tight relationships between Buddhist monasteries and the industrial or commercial exploiters of natural resources have no precedent."

PUZZLING OUT THE FULL meaning of Mes Aynak will require decades—and a new generation of archaeologists. After earning his degree at Kabul University, Sultan Masoud Muradi, 24, the son of a Kabul construction worker, competed to take part in excavations at the site. He's proud that he and his colleagues represent different ethnicities and work easily together—no small matter in a country riven in the 1990s by a horrific civil war among mujahideen groups divided along ethnic lines. "We have 5,000 years of history, and for Afghanistan's new generation, it's very important to know about it," he says, holding a small shovel while taking a break from digging. "Otherwise we are just famous for terrorism and poppy production."

MES AYNAK'S LANDSCAPE is completely deforested today, and it's possible that ancient copper smelting played a role in the area's denuding—which in turn may have ended copper production. Huge quantities of wood had to be burned to make charcoal, and up to 20 pounds of charcoal could be required to extract a single pound of copper from ore. Enough was needed to heat a fire to almost 2,000 degrees Fahrenheit and keep a small furnace roaring up to several days.

Thomas Eley, an archaeometallurgy specialist from Great Britain who did fieldwork at Mes Aynak in 2012, has detected a shift in its copper production over time from a relatively efficient form of smelting to a slower and more painstaking process—the opposite of what he'd expected to find. But the more efficient process, known as tapped smelting, also happens to be more fuel intensive. As the supply of trees for making charcoal dwindled, the smelters could have been forced to fall back on the slower method.

Processing so much copper also required a reliable water supply to wash the ore and quench white-hot ingots. That water probably came from mountain springs, shallow streams, and ancient underground *(Continued on page 128)*

Society Grant Satellite mapping of Mes Aynak was funded by your National Geographic membership.

ICONEM-DAFA, COMPOSITE OF 300 IMAGES (BOTH)

The Monks of the Mines

The fortified Kafiriat Tepe monastery, depicted here as it may have looked in the fifth and sixth centuries A.D., was part of the ancient mining complex of Mes Aynak, an affluent hub of Buddhism. The copper-rich region, 30 miles south of Kabul, more recently served as an al Qaeda training ground and a source of antiquities for looters. Archaeologists are trying to uncover and save what they can before the site becomes an open-pit copper mine.

SCALE VARIES IN THIS PERSPECTIVE. DISTANCE FROM KAFIRIAT TEPE TO SHAH TEPE IS 0.5 MILE (0.8 KILOMETER).

SOUTHERN CHAPEL
Massive clay statues of the Buddha, influenced by classical Greco-Roman and Indian art forms, are flanked by smaller depictions of devotees and bodhisattvas, those on the path to enlightenment.

FERNANDO G. BAPTISTA, RYAN MORRIS, AND EMILY M. ENG, NGM STAFF; PATRICIA HEALY. 3-D MODEL: ICONEM-DAFA.
ART: ROCIO ESPIN; JOSE DANIEL CABRERA. SOURCES: PHILIPPE MARQUIS; NICOLAS ENGEL; CATHERINE HEIM

GODLY AND WORLDLY

Kafiriat Tepe provided private areas for monks and public areas for general worship. Paintings in the halls and chapels celebrate both secular and religious powers. This suggests that the monastery was supported by the ruling elite, and could help shed light on Buddhism's social and political history.

STUPAS

Holes left by looters reveal that large stupas, venerated monuments housing sacred relics, may have been built over older, smaller ones.

STUPA COURTYARD

Prayer flags wave overhead as monks and visitors circumambulate stupas with enshrined statues. Soldiers stand guard along the defensive walls of the monastery.

Archaeologists have unearthed a neighborhood of mud-brick houses, craft workshops, and possible administrative buildings. Shah Tepe, looming behind, was fortified but bore few signs of violence.

PANORAMA COMPOSED OF THREE IMAGES

Ancient faces—of the Buddha, eight inches tall, in gilded plaster (above), and of local figures, in painted clay (far right)—evoke a time when Mes Aynak was a crossroads of Central Asia. The modern faces belong to members of the dig team working to save a piece of their country's rich cultural heritage from oblivion.

PATRON, 2.8 INCHES, 4TH-7TH CENTURY

PATRON, 5.9 INCHES, 5TH-7TH C.*

PATRON, 2.8 INCHES, 4TH-7TH C.

PATRON OR BODHISATTVA, 3.9 INCHES, 4TH-7TH C.

irrigation channels called karez, which are still used in parts of Afghanistan. One 30-foot-long karez has been excavated in the northern section of the site, probably part of a network of such channels. The ongoing deforestation could have reduced the area's rainfall, making water even scarcer.

A paucity of water remains a concern in this drought-prone region, and a major obstacle to future mining. Integrity Watch Afghanistan, a Kabul think tank, reported in 2013 that villagers around Mes Aynak complained that the water table dropped by more than six feet after preliminary drilling. "When copper production starts, it will require seven million liters [1.85 million gallons] in one eight-hour shift," says Javed Noorani, who authored the Integrity Watch report. "The area is already water deficient."

THE ARCHAEOLOGISTS MUST cope with a problem not of scarcity but of overabundance: The rate at which the excavation has proceeded risks outpacing the ability to store and protect everything coming out of the ground. "Excavation is easy," says Omar Sultan, Afghanistan's former deputy culture minister and a Greek-trained archaeologist. "Safeguarding is the hard thing to do."

More than a thousand of the most important pieces have gone straight to the National Museum of Afghanistan in Kabul. "Unfortunately we cannot accept all the artifacts," says Omara Khan Massoudi, for many years the director of the museum. "There is no place for them."

For now the thousands of Mes Aynak objects that aren't at the museum sit in temporary storage at or near the site. Most have not been analyzed or studied. Massoudi and Sultan talk of erecting a local museum someday, but more likely, at least in the short term, there would be a virtual museum and online reconstruction to preserve Mes Aynak's memory after the mining begins.

But first Afghanistan's security challenges must be resolved. And in the long term more mining delays could pose more dire threats. Mes Aynak's security depends in large part on ensuring that local men, vulnerable to the lure or coercion of the Taliban, stay gainfully employed. Many resent having been displaced from their villages to make way for the copper mine. The World Bank, which has been supporting the archaeological work through a project with Afghanistan's Ministry of Mines and Petroleum, estimates that the mine will eventually provide 4,500 direct jobs and many more thousands of indirect ones, though there's growing skepticism that the jobs will ever materialize.

Over the years a few hundred men have been paid generously by local standards to wield

U.K.-based photographer **Simon Norfolk** specializes in landscapes. Over the past 12 years he has explored through his work the meaning of the word "battlefield" and the many ways it can be interpreted.

Searching for treasure, looters ravaged this larger-than-life-size Buddha. "Archaeology is the only way to protect the site," says Philippe Marquis, who oversaw excavations until 2014.

pickaxes and shovels or do other menial work at the archaeological site. But "if you have no food or salary, when your children are hungry, you'll do anything," says Habib Rahman. "Maybe join the Taliban. They pay a salary." In 2001 the gray-bearded, 42-year-old father lost a leg to a land mine while herding goats. Now he walks with the aid of crutches two hours each way from his mountain village to wash pottery sherds at Mes Aynak.

The hardscrabble lives of locals like Rahman are not likely to change much in the immediate future. Many are ambivalent about the rich history they're helping reveal, feeling no personal ties to a pre-Islamic past. It doesn't help that the Taliban have threatened some workers, accusing them of promoting Buddhism. Still, there's admiration for the achievements of the past. "My forefathers were Muslim," says one 36-year-old laborer and Afghan Army veteran who gave his name only as Javed. "But we know a lot of generations passed through this ground. When I am working, I am thinking that here was a civilization, a factory, a city, kings here. Yes, this is Afghanistan also." □

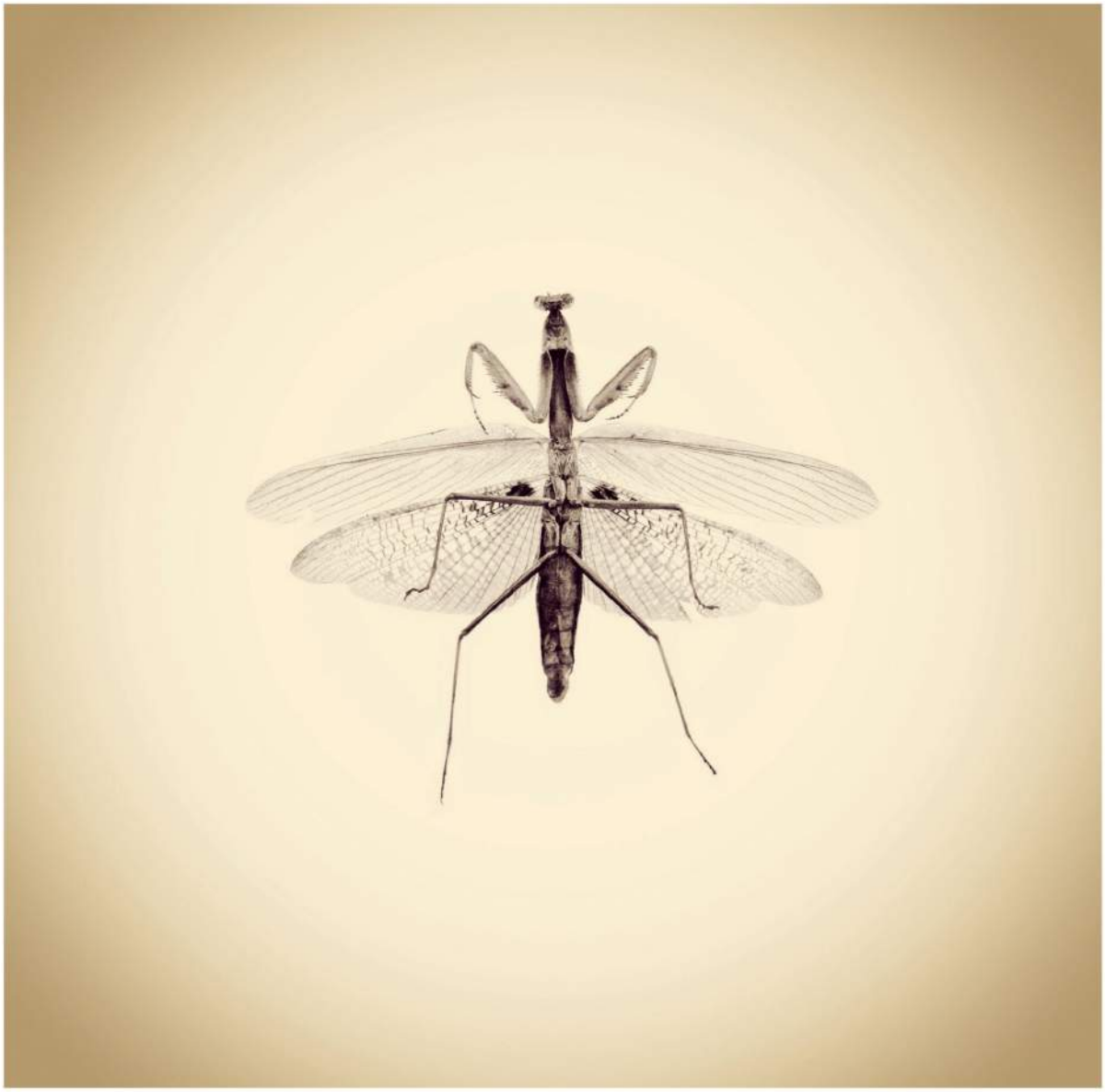
Fowler's toad *Anaxyrus fowleri*

Art from an American Backyard

By **JAMES ESTRIN**
Photographs by **JOSHUA WHITE**

When Joshua White was growing up in southeastern Indiana, he would lie in his backyard for hours observing ants and june bugs. He encountered the little creatures with a sense of wonder and struggled to understand the mysteries of the natural world. He captured his entomological discoveries in pickle jars, Styrofoam cups, or his hands.

White grew up to become an artist. He recently moved to North Carolina, where he still spends considerable time much as he did in childhood: walking near his house and carefully looking at his surroundings. What has



Praying mantis Mantidae

changed is that he now captures his tiny subjects with a smartphone camera that allows him to interpret them artistically and share them with viewers beyond his backyard.

His lifelong fascination with the natural world is embodied in his project "A Photographic Survey of the American Yard." Its sepia-toned photographs and design layout resemble the elegant, hand-drawn scientific catalogs of species of the 19th century.

Though Charles Darwin traveled great distances to observe and sketch plants and animals that existed in nearly inaccessible locations, White documents the plants and animals that are abundant in everyday life but are rarely considered noteworthy. "You don't have to travel to exotic locations to make an interesting picture," he contends. "Beauty is around us all the time."

White is convinced that most of us don't think often enough about the world we inhabit "or what goes on under our feet." The photographs he shares—on Instagram and Tumblr as well as in museums and art galleries—gently demand that attention be paid to beings that are, in many ways, the bedrock of the physical ecosystem. Though these creatures are often regarded as inconveniences or pests, White's images ask us to recognize not only that they're here but also that they're crucial. □

Black-eyed Susan *Rudbeckia fulgida*

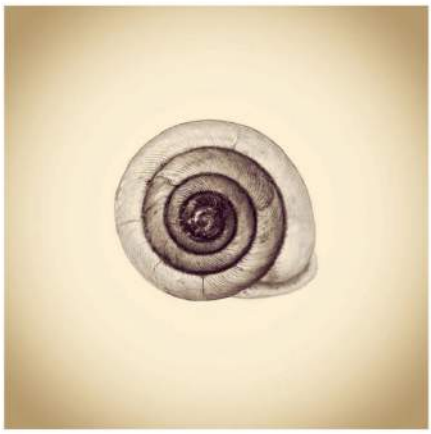
Horsefly Tabanidae

Centipede Chilopoda

Clematis flower bud *Clematis*

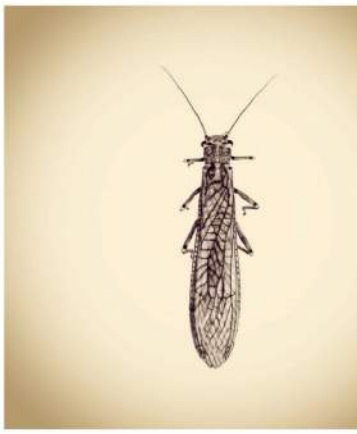
Toad *Anaxyrus*

Canna lily fruit (dissected) *Canna*

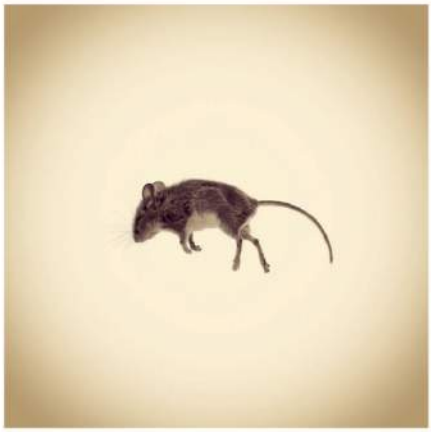


Garden snail shell Gastropoda

Crow garlic *Allium vineale*



Stone fly Perlidae



Deer mouse *Peromyscus*

Acorn *Quercus*

Asteraceae

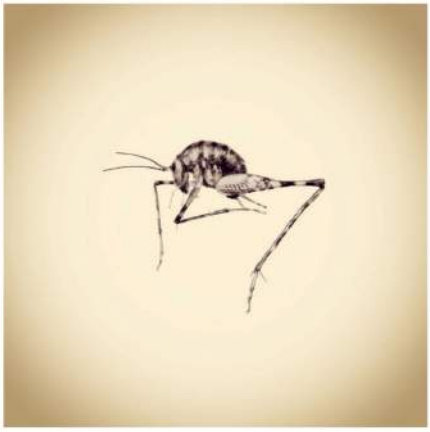
Jack-o'-lantern mushroom *Omphalotus*

Eastern gray squirrel *Sciurus carolinensis*

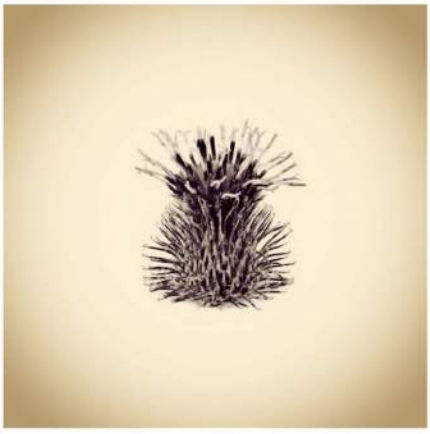
Holly seedling *Ilex*

Clematis (petals removed) *Clematis*

Carolina horse nettle *Solanum carolinense*



Cricket Rhaphidophoridae

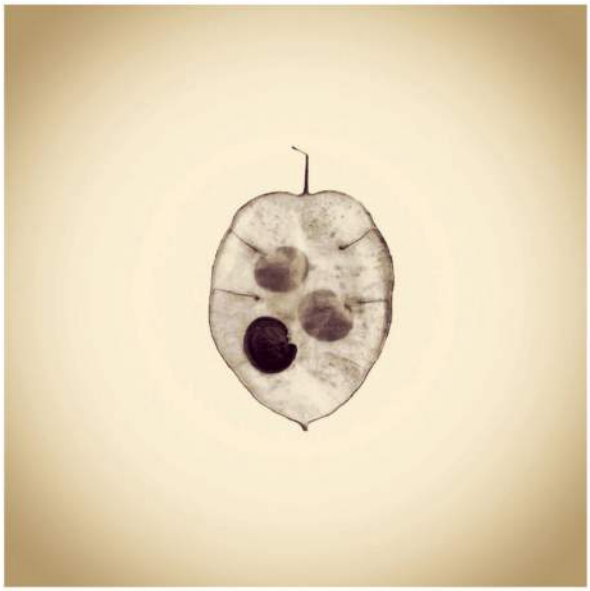


Common burdock *Arctium minus*

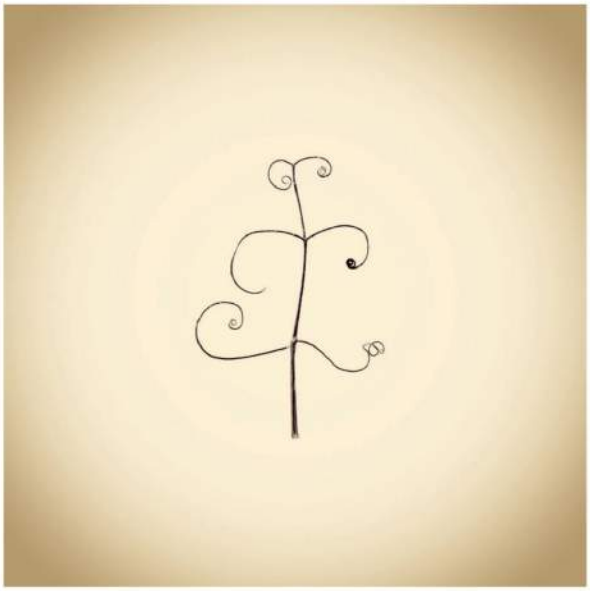
Bottle gourd *Lagenaria*

White's guides on his photographic safaris are his dog, Coco, and his daughter, Virginia, who proudly points out possible subjects. When plants, insects, and small animals catch his eye, White carries them home and photographs them with his iPhone on a white background. After converting the photos to black and white, he adds a filter, aptly named Earlybird. All fauna shown were found dead except the Fowler's toad; White photographed it quickly before setting it free.

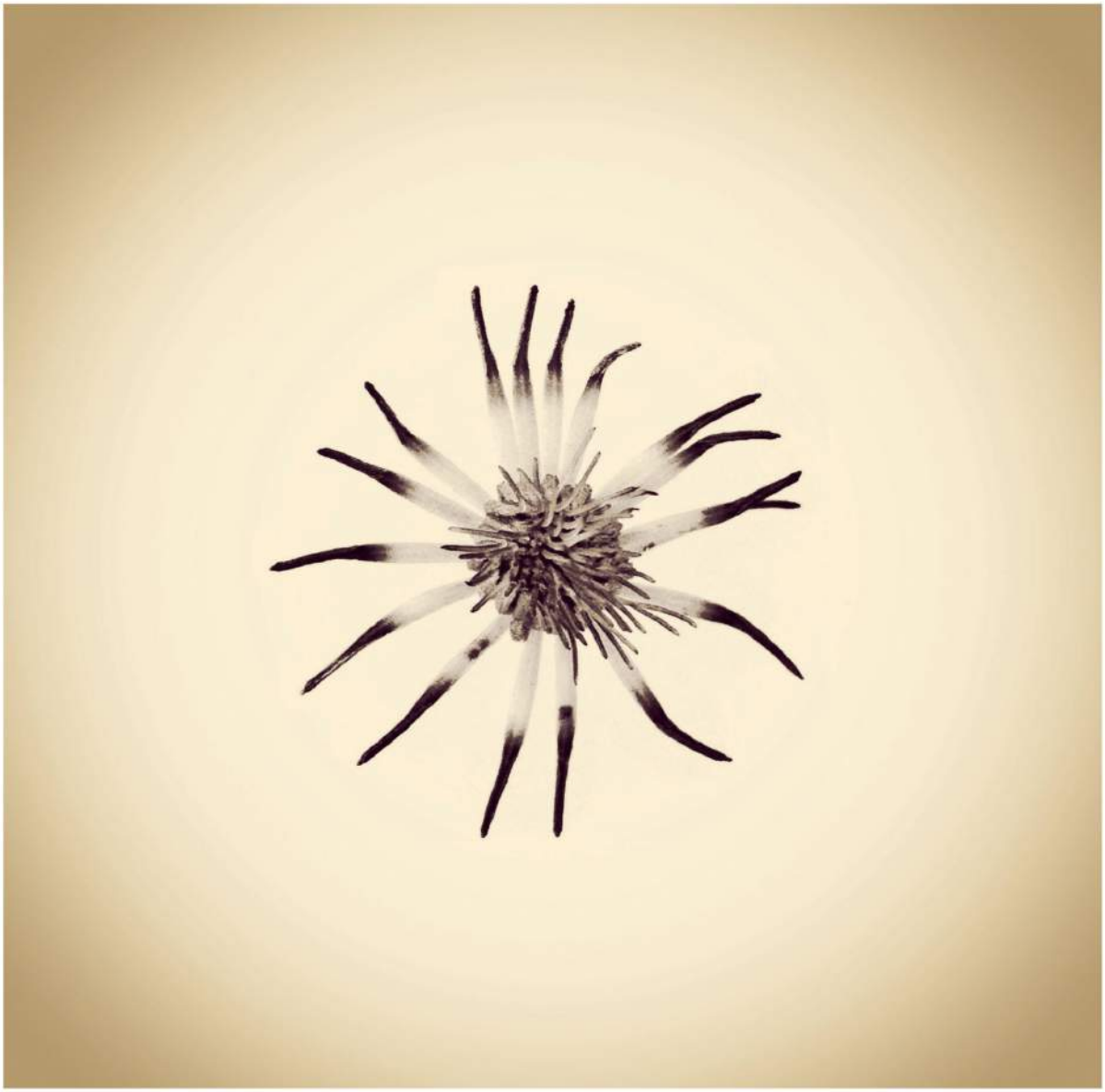
Passerine eggs Passeriformes



Annual honesty *Lunaria annua*



Wild grape vine tendril *Vitis*

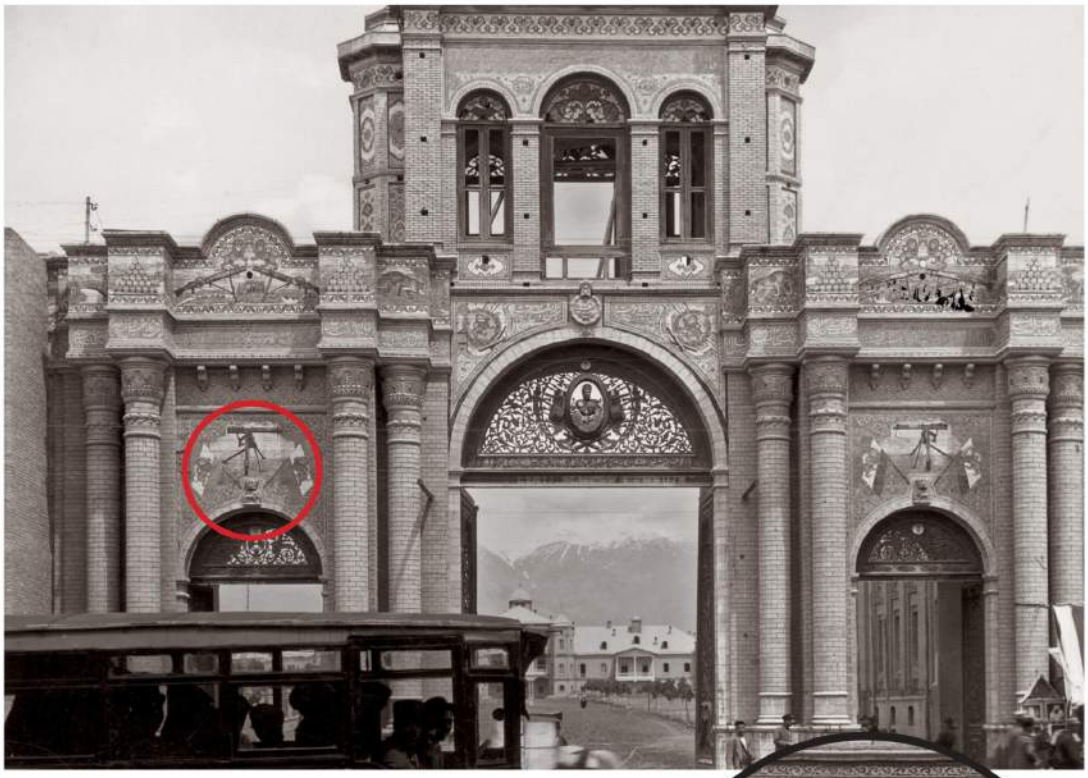


Clematis (petals removed) *Clematis*

White's subjects are neither rare nor exotic, at least not in West Jefferson, the small town in the North Carolina Blue Ridge Mountains where he lives. But he wonders whether in 50 years some of the flora or fauna he's photographed will be endangered or extinct because of climate change. Though mainly interested in the beauty inherent in his subjects, White says he hopes the photos remind viewers of their own childhood encounters in the natural world.

In the Loupe

With Bill Bonner, National Geographic Archivist



Armed Guard

Maynard Owen Williams photographed Tehran's Bagh-e Melli gate—then an entry to the Ministry of War complex—while working on a story for the October 1931 *National Geographic.* The 1906 structure echoes traditional Persian architecture, but a look through the loupe reveals a modern twist: Decorative tiles showing machine guns adorn the facade.

Today the gate still stands, and the machine guns remain. The tile-work flags on either side of the guns, though, have been painted over to conceal the central image of a lion and sun, long-time symbol of Iran's rulers. *—Margaret G. Zackowitz*

PHOTO: MAYNARD OWEN WILLIAMS, NATIONAL GEOGRAPHIC CREATIVE

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Gray Bamboo Lemur
(Hapalemur griseus)
Size: Head and body length, 28 - 30 cm (11 - 11.8 inches); tail, 35 - 37 cm (13.8 - 14.6 inches)
Weight: 800 - 967 g (1.76 - 2.13 lb)
Habitat: Primary and secondary forest with bamboo stands or patches of dense bamboo vines
Surviving number: Unknown

Photographed by David Hosking

WILDLIFE AS CANON SEES IT

Bamboo's biggest fan? The gray bamboo lemur can certainly make a strong claim to the title, as it spends much of its time searching out the tastiest morsels of bamboo. Living in groups of two to seven, this smallest of bamboo lemurs uses scent marking and vocal displays to defend its home range from neighboring groups. Every newborn is protected too, with its mother carrying it around in her mouth for the first few weeks. But nowhere in the forest is truly safe from the biggest threats the lemur faces: habitat loss and hunting.

As Canon sees it, images have the power to raise awareness of the threats facing endangered species and the natural environment, helping us make the world a better place.

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